SCIENTIFIC AMERICAN

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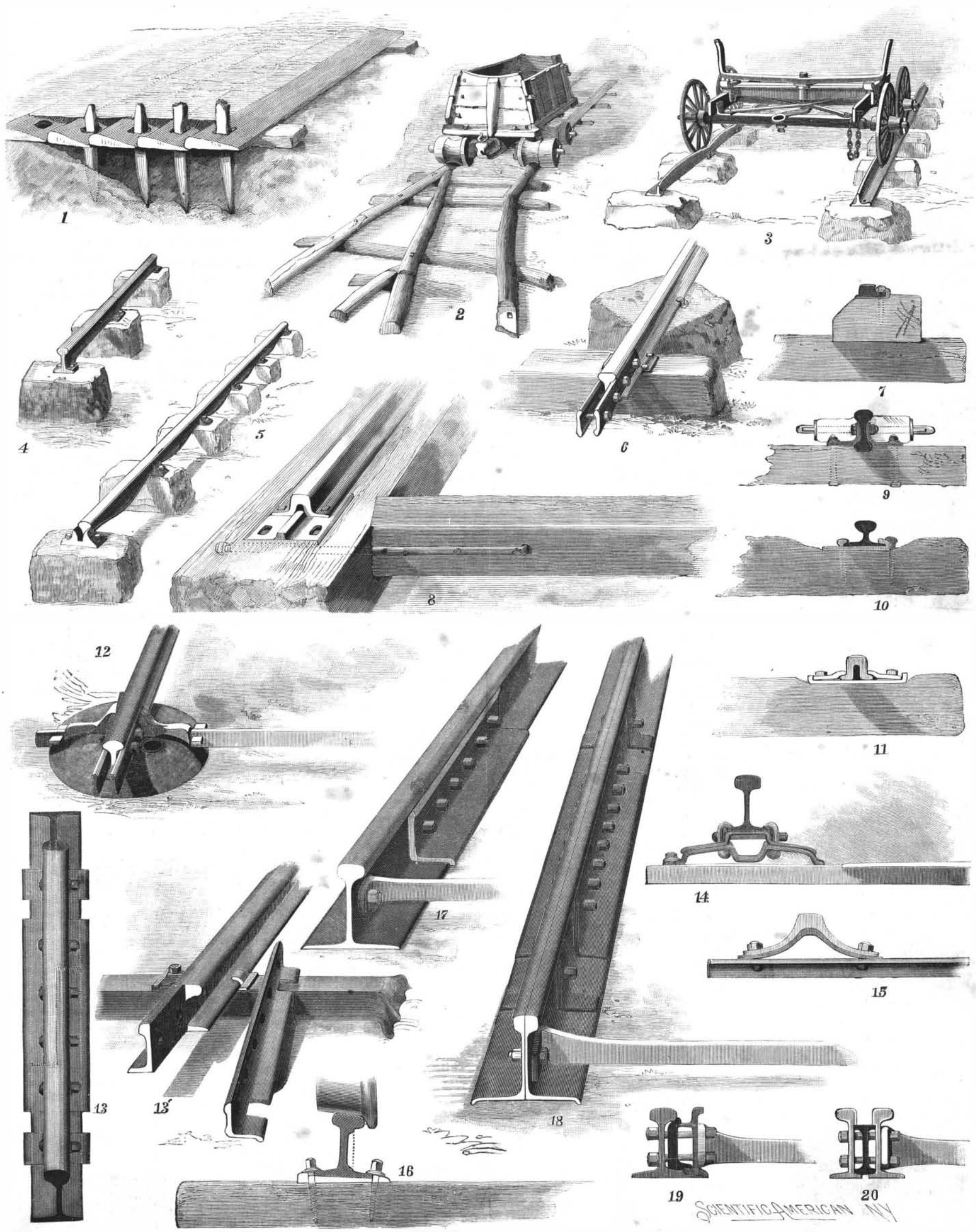

RAILROAD CONSTRUCTION IN ALL AGES—THE GREAT EXHIBIT OF RAILS AND RAIL JOINTS AT THE COLUMBIAN EXPOSITION.—[See p. 375.]

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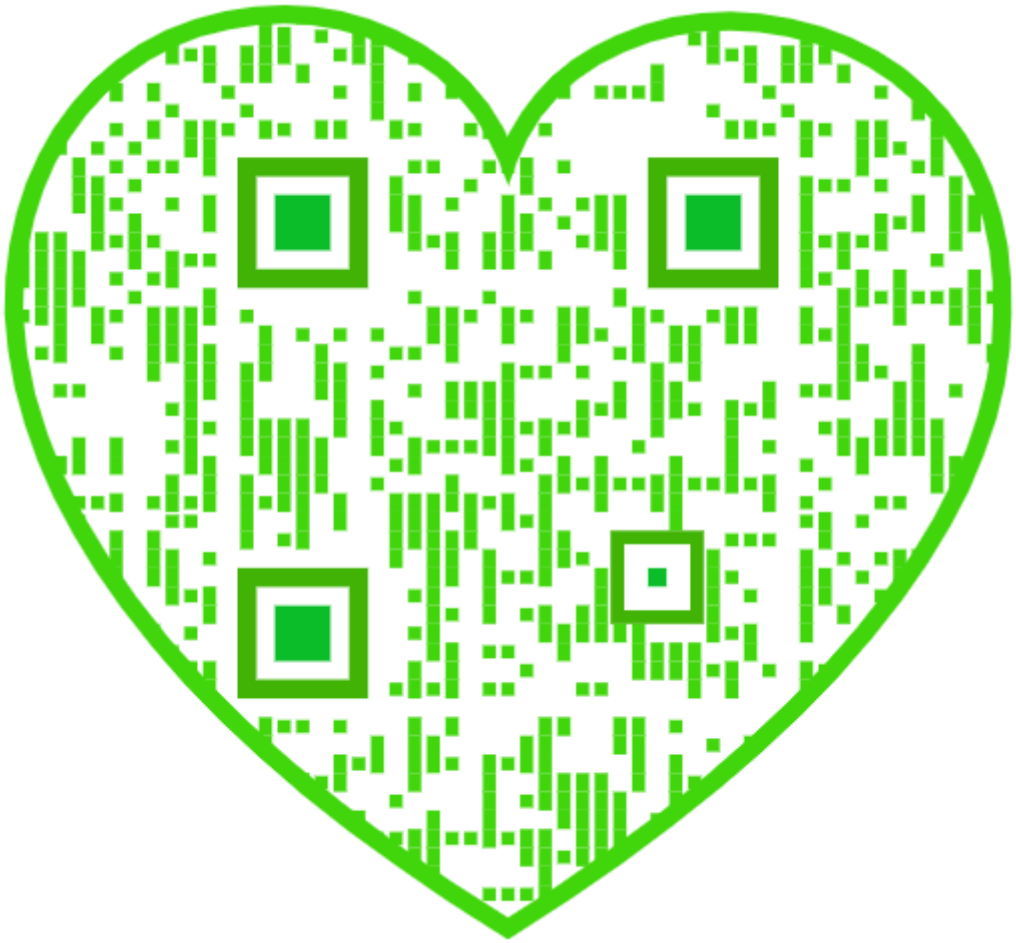

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"GASOCUTION."

The editorial in your issue of November 18, on "Death by Gas Asphyxiation," prompts me to suggest a question which has often occurred to me, as it doubtless has to others, why this would not be the best method of executing the death penalty upon criminals. Hanging is shocking to the finer sensibilities of mankind, and "electrocution" is not considered by many as altogether satisfactory; but execution by carbonic acid gas would be free from every objection that could be brought against either of the methods named. For instance, let a cell be constructed which, to a certain height, would be gas tight. The upper portion could be freely ventilated, so that it could be used for ordinary purposes. All that the prisoner would need to know would be that he entered that cell never to come out alive; and when reclining upon his couch the gas could be turned in till it enveloped the sleeper, who, without waking, would pass quietly away. Or, if it be desirable to let the prisoner know when he is to be executed, he could be confined upon his couch or chair and the gas introduced, which would not reveal its fatal presence till it reached the requisite height, when, as you show, the person would instantly become unconscious, and soon cease to live. Then, by some simple process, the gas could be exhausted from the cell and the body removed. In this case the death would be painless and absolutely sure. The process would be free from all sensationalism or ghastly accompaniments. It would require no expensive plant, machinery, or operators, and would be in harmony with the highest dictates of humanity. Is it not at least worthy of consideration? URIAH SMITH.

[The system of inflicting death by electrocution is undoubtedly successful, but none the less is an absurdity as regards expense and complication of apparatus. When we consider that the puncture of a needle can kill, the use of an expensive electric plant for the purpose seems unnecessary. The execution by carbonic acid gas, in the style of "Armadale," is also clumsy, as a great quantity would be required to fill a room to the necessary height. But by the use of illuminating gas one or two cubic feet would do the deed. A simple tin box could be placed over the criminal's head and gas could be turned into it. In a few minutes painless death, without mutilation, would ensue. The method would be certain, and the apparatus would cost little. Death would not be instantaneous, but it is questionable if society does not carry its philanthropy too far in its efforts to provide euthanasia for brutal murderers. —ED.]

THE WRECK OF THE LOUISE H. RANDALL.

The past week has witnessed a scene enacted on the shore of Long Island which brought near to our doors the battle of human life with the elements, and which, after long agony of suspense and suffering, ended happily. We allude to the wreck of the schooner Louise H. Randall. Carrying a heavy cargo and caught in a gale off the inhospitable shoals of the southern shore of Long Island, she grounded. She was at once seen some six hundred yards distant from shore, and the life savers began to congregate on the beach near her. The first thing to be done in such a case is to get a boat to the wreck. The use of the life boat is preferred to the breeches buoy when it can be used. But, after repeated and desperate efforts, the attempts to get a boat offshore were abandoned as useless. The wrecked vessel meanwhile lay in full sight of the shore, with hull immersed and her crew and officers with the captain's wife fastened in the masts and rigging. What their thoughts must have been as they saw the crowd on the shore and no boat putting off can be imagined.

The mortars and life lines were next tried, and shot after shot was discharged all falling short or missing the vessel, except two. These fell across the hull only to be cut by the wire rigging. In face of the gale and distance of the vessel from shore, the Federal Life Saving Service was helpless. Private assistance had to be invoked. The powerful seagoing tug of a wrecking company was dispatched from New York, eight hours distant, and reached the scene in time to rescue the unfortunates, who for a day and a night had been exposed to the sea and wind on the masts of the sunken vessel. Had the wreck occurred in January or February, probably all would have been lost. Human ingenuity and the philanthropic spirit of a great government proved unable to throw a half inch rope over a vessel in plain sight off a level sand beach. A number of life saving crews were assembled, but they could do nothing.

Our life saving service is admirable in many respects. Its use of light surf boats in place of the heavy life boats used in England is characteristic. The English type could not be launched from our sand beaches. The same thing operates against the use of steam life boats. But where a coast is so notoriously unsafe as that bordering on the bay of New York, it would seem possible for the life saving department to maintain a steamer ready for instant call to the relief of a distressed vessel, anywhere from Montauk Point to Barnegat. It would also seem possible for more powerful line-throwing apparatus to be provided.

Another striking feature may be noticed. Life saving operations are always operated from the shore. But would it not be possible for a ship to do something herself? The use of drags to carry a line to shore has been proposed, and Professor Davis' kite gives some suggestion to the shipwrecked. When a captain finds his ship going ashore, if he could but secure enough light line, it should be a simple matter to rig up some kind of a float which would, under the influence of the wind and "send" of the breakers' crests, carry the end of the line ashore. This would give the necessary facilities for carrying out a breeches buoy tackle. In the accounts of the wreck it is said that even the empty donkey boiler was carried ashore. This would have had power to carry the end of a heavy rope on shore had a long enough one been at hand. Life and death hinged upon getting a line across six hundred yards of water, and it could not be done.

The account of the wreck and rescue reads like a romance in every detail. The work of the life saving crews was heroic, if ineffectual. But it should have been effectual.

Manufacture of "God" Money in China.

A correspondent of the *North China Herald*, writing from the interior of Kiangsu province, mentions that one of the industries there is the manufacture of mock money for offering to the dead. Formerly the Chinese burnt sham paper money, but in these days of enlightenment and foreign intercourse the natives of Soongkong, Hangchow, and other places have come to the conclusion that dollars are more handy to the ghosts than clumsy paper money. Hence they now to a great extent supply their ancestors and departed friends with mock dollars. These are only half the size of real dollars, but there appears to be no more harm in cheating the dead than there is in cheating the living. Besides, the deceased are not supposed to know the difference, for many of them departed this life before silver dollars were imported into China. A hundred mock Carolus dollars, done up in boxes, are sold for 34 cash. The operation of making this money is interesting. First of all there are blocks of tin which are melted down and then poured between boards lined with Chinese paper, and when the upper board is pressed down on the lower, a thickness of tin remains. This is next cut up into strips four inches long, one wide, and an eighth of an inch thick. Some ten of these strips are placed evenly together, one on top of the other, and one end is held between the fingers, when the workman proceeds to hammer them out till he has beaten them so fine that they are now three feet long and a foot broad, and so thin that they are not thicker than the thinnest paper. This is next pasted on common cardboard, which is then cut with a punching machine to the size of half dollars, and this having been done, a boy takes the cut-out pieces in hand and with two dies, one representing the one side and the other the reverse, hammers impressions of dollars on them, and the money is ready for use.

Another very curious instance of the practice of cheating the gods is recorded in the same journal, but from quite a different part of the country. It appears that districts of the Anhui province have lately been ravaged by an epidemic, so that in many places the people were unable to attend to the harvesting of the crops. An attempt was then made to deceive the gods by "playing at" New Year's Day, and pretending that September 1 was the first day of the new year. Every preparation for celebrating the bogus new year was made, such as burning fire crackers and pasting happy sentences in red paper on the doors. The object was to make the god of sickness think that he had made a mistake in the seasons and had erred in bringing an epidemic on the people at a time when no epidemics in the course of nature should appear. As any action contrary to nature done by the gods is liable to punishment by the King of Heaven, the actors in this farce thought that the god of sickness would gather his evil spirits back to him for fear of the displeasure of his superior divinity. This child's play received the permission and co-operation of the local authorities, but so far no visible effects for the better are apparent.

Recruits of the American Army.

The *Army and Navy Journal* says: Of the nearly 10,000 men enlisted in the army during the past year, seven placed themselves on record as lawyers, three as dentists, two as chemists, thirty-nine as druggists, six as newspaper men, eight as civil engineers and surveyors, two each as actors and artists, four as draughtsmen, and sixty-two as school teachers. Twenty-six students entered, thirty-nine salesmen, thirteen photographers, and one doctor. One music teacher and a piano tuner were accepted, and are now in service; carpenters numbered 204; painters, 106; cooks, 108; machinists, 106; butchers, 104; printers, 95; and bakers, 91. Of 86 who gave no occupation, 78 were

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Indians and 8 white men, and of the 2,240 laborers enlisted 13 were Indians. Farmers numbered nearly 1,200; clerks, 377; farriers, 16; blacksmiths 96; teamsters, drivers, and coachmen, 376; horsemen, 2; horse trainers, 3; liverymen, 2; jockeys, 2; riding teacher, 1; and hostlers and grooms, 92. The bookkeepers were 52 in number; stenographers, 7; hotel clerks, 3; typewriters, 2; and shipping clerk, 1. There were besides 86 tailors, 77 miners, 78 barbers, 75 engineers, 74 shoemakers, and 69 sailors.

Solar Cautery as a Remedial Agent.

We give a brief abstract from an article on this subject, by Dr. A. V. Thayer, published in the *Pacific Medical Journal.*

During a practice of more than a quarter of a century I have found no caustic or cautery to compare with solar heat in its beneficial results. Unlike other caustics, it can be applied with perfect safety upon the most delicate tissues, and is at all times under the control of the operator. It has other advantages—the system receives this treatment kindly. The irritation and inflammation following its application is surprisingly slight and of short duration. Another point in its favor, the pain subsides immediately upon the removal of the lens. I have burned the skin of nearly the whole of one side of the face at one sitting, destroying the cuticle; within five minutes the burned surface would be free of pain. There is a curative power in the chemical rays of the sun yet unexplained. I avoid blistering, carrying the burning beyond this point, carbonizing the tissue.

In the treatment of morbid or malignant growths we destroy most fully the morbid products. Upon this depends the success of the operation. The morbid tissues having less vitality than the normal, succumb to the cautery before the natural structures adjoining are injured. This enables us to attack boldly the malignant or morbid growths without any fear of injury to the healthy tissues surrounding them.

In the primary treatment of chancre, or chancroid, this treatment stands unrivaled. Within the space of two minutes the infectious chancroid, or the true Hunterian chancre, is deprived of its contagion and changed to a simple ulcer. Hemorrhoidal tumors, when external to the sphincter, are bodily destroyed, and the part heals without unpleasant symptoms. Indolent ulcers of long standing take on new life after the application of solar heat. In the course of a few days healthy granulations appear, which continue to a favorable termination, especially when the general health is looked after. Granular surfaces which are inclined to bleed from the slightest touch are changed to a healthy state. Hemorrhages from small arterial or venous vessels are checked almost instantly with the solar cautery.

Diseases of the skin of a parasitic nature are treated with marked success. Cases that have withstood the repeated attacks of the usually prescribed remedies have succumbed to one or more applications of solar heat. I believe that the pustules of smallpox can be aborted, and pitting prevented with this agent.

What seems surprisingly strange to me is the fact that a remedy of so much curative power and value, and one so easily utilized, should have remained unknown to the medical profession so long.

[If medical men were more careful to read the pages of the SCIENTIFIC AMERICAN with regularity, they would keep themselves posted in respect to the latest and most valuable medical discoveries. The use of the solar cautery was the discovery of Augustus Barnes, of Southington, Conn., was patented by him May 28, 1867, and described that year in the SCIENTIFIC AMERICAN. —ED. S. A.]

The Rose Garnet Rock of Morelas, Mexico.

Pliny, in his voluminous and discursive "Natural History," reaches in the 36th book the subject of building materials. In his omnivorous, predatory and unsystematic manner, he narrates what architectural wonders have been accomplished and descants with philosophic gravity upon the dangerous luxury which has been fostered by the discoveries of fair and attractive stones. In looking at the unique and attractive slabs of the rose garnet rock (rhodolite) exhibited at the Lincoln building, New York, under the direction of Mr. Niven and Mr. Atkinson, the visitor was struck with a feeling of curiosity as to what the appreciative Roman historian would have said at this singular and gay material. In a mottled matrix of yellow and white, sparsely dotted with irregular areolae of gray, appear blossoms of pink garnet. In certain lights and in examples of exceptional excellence, the novelty of the effect is certainly pleasing and surprising. Pliny would have rewarded it with his sedate praise, but the Roman voluptuaries, doubtless, would have adapted it in their domestic ornamentation, their veneered walls, their baths and tables, their tesselated pavements, and their columned porticoes. It would seem well suited for many ornamental purposes to-day. It varies somewhat in its brilliancy, but the different tints could be successfully separated and used in different connections and for different purposes. This interesting material is a strong, tough aggregate of wollastonite, vesuvianite, and garnets, the whole somewhat penetrated with silica and here and there holding limestone granules and crevices. The wollastonite, vesuvianite, and essonites (to which grade of garnet these may be assigned) are frequent associates in volcanic rocks, and we may confidently conclude that igneous action has assisted the development of this triple mineral alliance in this case also. It is a metamorphic result produced in a limestone region, assisted by the infiltration of silicious waters. The garnets afford evidence of growth where in the cut sections the polygonal rulings reveal their polyhedral accretion, and in places there are traces of subsequent alteration in crystallized calcite. The quarries are situated on a hill top about ten miles from Cuautla, in the state of Morelas, Mexico, and within sight of the snow-wrapped pinnacle of Popocatapetl.

This stone is in the neighborhood of heavy bodies of eruptive rock and the agency of heat has effected the development of these minerals under aqueous conditions which permitted the chemical and physical separation of these silicates. Two hundred and forty thousand tons of this rock are in sight, and the resources of the locality seem inexhaustible. The stone has been at last successfully treated so as to secure a polish, and we think used in connection with a green stone (serpentine, jade, nephrite, prase, malachite, etc.), as a border or frame, its beauty would be greatly enhanced, and that it would present upon walls or in mantel and table tops a very attractive appearance. It varies in quality and here, as in all other stones, selection is desirable. In columns the effect is cheerful and pretty, and in columns of considerable dimensions and some height, with a granite polish, we could imagine the effect excellent. It will naturally attract attention, and challenge the criticism and careful scrutiny of architects, decorators, and builders.

Exposition Items.

The lost and found department at the Exposition has collected a motley variety of curiosities. There have been an average of two hundred articles lost each day of the Exposition and only one-half of these have been returned. One would suppose that umbrellas would constitute a larger part of this collection, but women's handbags take the lead, and these bags contain almost everything, from a piece of chewing gum to rolls of bills and railroad tickets, but unfortunately no name or address by which the owner can be identified. Visitors have not neglected to leave umbrellas, as about two thousand still remain uncalled for. The number of wraps that have been found would supply a good sized second hand clothing establishment, and in variety of cut and cost of material they would give points to any clothing establishment in the country. Most of the wraps are women's wear, but men have not been any too careful in forgetting their overcoats. Quite a number of watches have been reported as lost. but the number reported found has been small. Many lunches have strayed away, which is a surprise, as one would naturally suppose that such a package would be closely watched. One of the first curiosities added to the collection was a clothes wringer. A little later a policeman lost his billy and a Columbian guard his sword. Evidently the guard was too much mortified to confess his loss, but as his number was on it, it was returned to him. The Woman's building has led all buildings in the number of lost articles and the Art Gallery has been a close second to it. Now that the Exposition is closed, this collection of articles will be classified and arranged and a full list published, so that people who have lost articles may have opportunity to reclaim them, but unless this is done within a certain time, an auction room will take possession of everything.

An exhibit in the Educational Department that attracted a great deal of attention from teachers is the method of teaching mathematics as exploited in the Washington public school at Hackensack, N. J., by Professor Nelson Haas. The general principles of this system were shown in the New Jersey educational exhibit, the foundation idea being to combine the abstract with the concrete, so that the pupil can comprehend in a practical way what he is trying to do. In the primary grades, where children from six to eight years old are taught the rudiments of mathematics, each problem is illustrated by drawing and frequently coloring the articles referred to. Thus in addition or subtraction, if certain quantities of apples are to be added or subtracted, the pupil draws the number of apples represented, so that he has before his eyes a practical demonstration of the problem. In the more advanced grades the pupils are asked to find how many yards of carpeting of certain widths would be required to cover a floor, or how much plastering to cover the walls of a room, and similar practical problems. In each case the room or other subject of the problem is outlined in a drawing, so as to put before the eyes of the pupil a natural demonstration of what is wanted. This system has proved so efficient that the cadetships in this district of New Jersey for both Annapolis and West Point are taken by students who were educated under this system. The same principles are carried out in higher mathematics on a similar plan, so that pupils from fourteen to eighteen years of age seem to have a clear comprehension of problems in algebra, trigonometry and even differential calculus. In this same section there was shown a system of teaching music by means of picture scales that attracted a great deal of attention from educators.

Every visitor at the Exposition heard a great deal about "fakes" in Midway Plaisance and no doubt encountered several of them, but one deception has just come to light which will disappoint many people. Probably no character in the Midway was talked about more than "Far Away Moses," who was connected with the Constantinople bazar. This individual was made famous by Mark Twain, and nearly every American who has visited Constantinople since Mark Twain's memorable visit has made use of this guide. When the Constantinople bazar was opened it was heralded broadcast that "Far Away Moses" was on hand to receive his old friends and patrons, and scores of these people have hunted him up. Since the Exposition has closed it has been discovered that the original "Far Away Moses" died some three years ago and that this counterpart is an individual resembling him, who was brought to Chicago because of the trade he might draw because of his name.

A photograph that was shown in the English section of the Exposition of a pile of 20,000 billiard balls told a surprising story of the slaughter of elephants to provide ivory for this one purpose. An average of ten balls is made from a pair of tusks; thus this pile of balls represented a slaughter of 2,000 elephants for this purpose alone.

Death Rate of Large Cities.

Statistics are given below compiled for the first half of this year by Secretary Carter, of the Maryland Board of Health, showing the mortality in various cities of this country and Europe having a population of more than 100,000, and they will be found of considerable interest. They are as follows:

	Population.	Deaths.	Death rate per 1,000.
London	5,849,104	55,895	19·11
Paris	2,424,705	28,675	23·61
New York	1,801,739	23,856	26·47
Berlin	1,669,124	17,181	20·58
Chicago	1,458,000	13,590	18·95
Vienna	1,435,931	18,005	25·07
Philadelphia	1,115,562	12,249	21·95
Brooklyn	978,394	10,682	21·84
St. Louis	520,000	4,802	18·47
Brussels	488.188	4,359	17·86
Boston	487,397	5,816	23·88
Baltimore	455,427	4.806	21·10
Dublin	349,594	4,735	27·05
San Francisco	330,000	3,006	18·21
Cincinnati	305,000	3,000	19·67
Cleveland	290,000	2,538	18·19
Buffalo	220,000	2,361	16·28
Pittsburg	255,000	2,923	22·92
New Orleans	254,000	3,598	28·72
Edinburgh	267,000	2,572	19·22
Milwaukee	250,000	2,000	16·00
Louisville	227,000	1,630	14·80
Minneapolis	209,000	1,004	9·60
St. Paul	155,000	745	9·61
Christiania, Norway	156,500	1,385	17·75
Denver, Colo.	150,000	871	11·61
Rochester, N. Y.	144,834	1,291	17·87
Reims, France	105,408	1,503	28·62

Gigantic Electrical Machines for Niagara.

The Cataract Construction Company has recently awarded to the Westinghouse Electric and Manufacturing Company the contract for building the immense generators, etc., for the transmission plant at the Falls.

The machines are to be built from designs prepared by Messrs. Coleman Sellers and George Forbes, the engineers of the Cataract Company, and will be many times larger, *Electricity* says, than any that have been built heretofore.

The apparatus will be built in units of 5,000 horse power. The revolving field of the generators is to be constructed with inwardly projecting poles, and will revolve in a horizontal plane, being mounted upon the vertical shaft of the turbine. The contract covers three dynamos of 5,000 h. p. each.

The weight of the shaft, turbine and armature is to be carried by the upward pressure of the water columns producing the heads for the turbines. The electromotive force generated will be 2,000 to 2,400 volts, and will be increased by step-up transformers for long distance transmission and lowered by reducing transformers for distribution. The motors will be the two-phase Tesla motors, which have been found to be well adapted for power purposes. The system adapts itself readily to the use of motor generators or rotary transformers, so that it is possible to develop either single-phase alternating currents or continuous currents of any desired electromotive force as may be required for the uses of individual customers.

The chief officers of the Cataract Construction Company are: Edward D. Adams, president, Francis E. Stetson, Edward A. Wickes, Wm. B. Rankin and Dr. Coleman Sellers as engineer, with Prof. George Forbes, of London, as consulting engineer.

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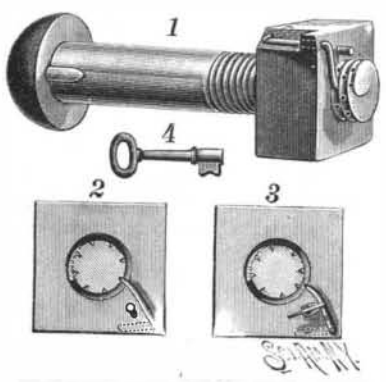
AN IMPROVED NUT LOCK.

This nut lock is especially adapted for securing the fish plates upon railroad rails and other similar uses. It has been patented by Messrs. Joseph Harmon and George W. Faber, of Fergus Falls, Minn. Fig. 1 shows the application of the device, Fig. 2 being an end view representing the nut engaging the bolt, and Fig. 3 showing it disengaged, while Fig. 4 is a key used to release the lock. In one corner of the nut is secured one end of a piece of spring wire, as shown in Fig. 1, the other end of the wire being bent at a right angle to lie against the outer side of the nut and form a locking limb, pointed and slightly curved near its end. In the bottom of the spiral track of the bolt thread are a number of cupped indentations, adapted to be readily engaged by the pointed end of the locking limb, the latter springing sufficiently to permit the nut to move freely as it is screwed upon the bolt body, but preventing backward movement of the nut by its engagement with one of the indentations. To disengage the spring locking limb from the bolt, the key is placed on an adjacent post in the end wall of the nut, and the turning of the key springs the locking limb away from the bolt, one key serving for use with any number of similar nut locks.



HARMON & FABER'S NUT LOCK.

A Successful Storage Battery Electric Car.

At Oneida, N. Y., they have a street car propelled by storage batteries made by the Syracuse Storage Battery Company. The total run on one charge of the batteries was 125 miles. The car makes daily from 64 to 90 miles without a break in the service. The 125 mile run was made on a seven hour charge. There are 96 cells used in the car. The motor is a single 30 horse power Rae type, with truck made by the McGuire Company, of Chicago. The motor and truck were purchased of the Detroit Electrical Company. The motor is wound for 190 volts. The voltage of the 96 cells at the start of the 117 mile trip was 204; at the end, 192 volts, a loss of only 12 volts in a day's trip. The car is lighted from a bank of 24 cells with 48 volt incandescent lamps.

A PNEUMATIC VENTILATOR.

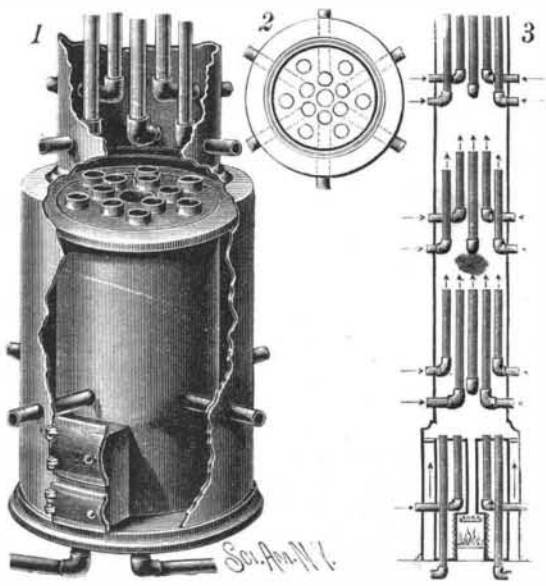
This improvement, patented by Mr. William R. Macdonald, of Allegheny, Pa., comprises a main ventilating flue containing within itself auxiliary vertical tubes, having elbows at right angle connections at various levels, forming inlets for the tubes at the sides of the main flue, there being a heater within or contiguous to the main flue. Fig. 1 shows the lower part of such a main flue, provided with a heater and firebox, Fig. 2 being a plain view, and Fig. 3 a sectional side elevation representing the air inlets as the apparatus would be arranged for the different floors of a building. The lower tubes, from the hot air generator, discharge a powerful upward blast of heated air against and around the tubes projecting into the main flue next above it, the second set of tubes in like manner discharging just below the tubes entering the main flue at a higher level, as shown in Fig. 3, the arrows indicating the direction of the air currents. With this arrangement all air entering the main flue is heated before its discharge into the flue, thus adding to the velocity of the upward current, and creating a draught which forms a most efficient means of ventilation, the inlets for the exhausts being placed where it may be most convenient, or in proximity to any particular location, where it may be most necessary to insure a constant circulation of air.

WORK ON THE SEWERS OF PARIS.

The administration is at this moment putting in execution with great activity the realization of the programme of the cleansing of the city of Paris through the application of the *tout a l'egout*. After long studies of various systems, it is, as well known, the one recommended by the late Mr. Durand-Claye that finally triumphed. It consists in purifying the sewage water by the action of a permeable soil combined with the vegetation. The sewage water begins by filtering completely in traversing the superficial strata of the soil. Then the dissolved organic matter descends through the strata of the subsoil, where it comes into intimate contact with the oxygen of the air, which fills the interstices between the solid molecules.

It was at Gennevilliers, near Paris, that the first experiments were made, and pursued upon quite a vast scale. It was found therein that 15 grains of sewage water contain 20,000 microgerms, while the same 15 grains of water making its exit from the drains of the irrigation grounds contain no more than 12. This encouraging result served as a base for the generalization of the system that is operating at this moment. The grounds of the peninsula of Gennevilliers comprise 1,600 acres of irrigatable and absorbent superficies. They are receiving and purifying at present 5,280,000 cubic feet of water a day, that is to say, a little more than a third of the production of the city of Paris, which is about 14,784,000 cubic feet a day. The 9,504,000 cubic feet excess are thrown into the Seine, and this figure can only increase. It, therefore, became necessary to seek new absorbing grounds in the vicinity of the capital. After a profound geological and agricultural inquiry, they were found at Acheres, at Mery-sur-Oise and at Meulon.

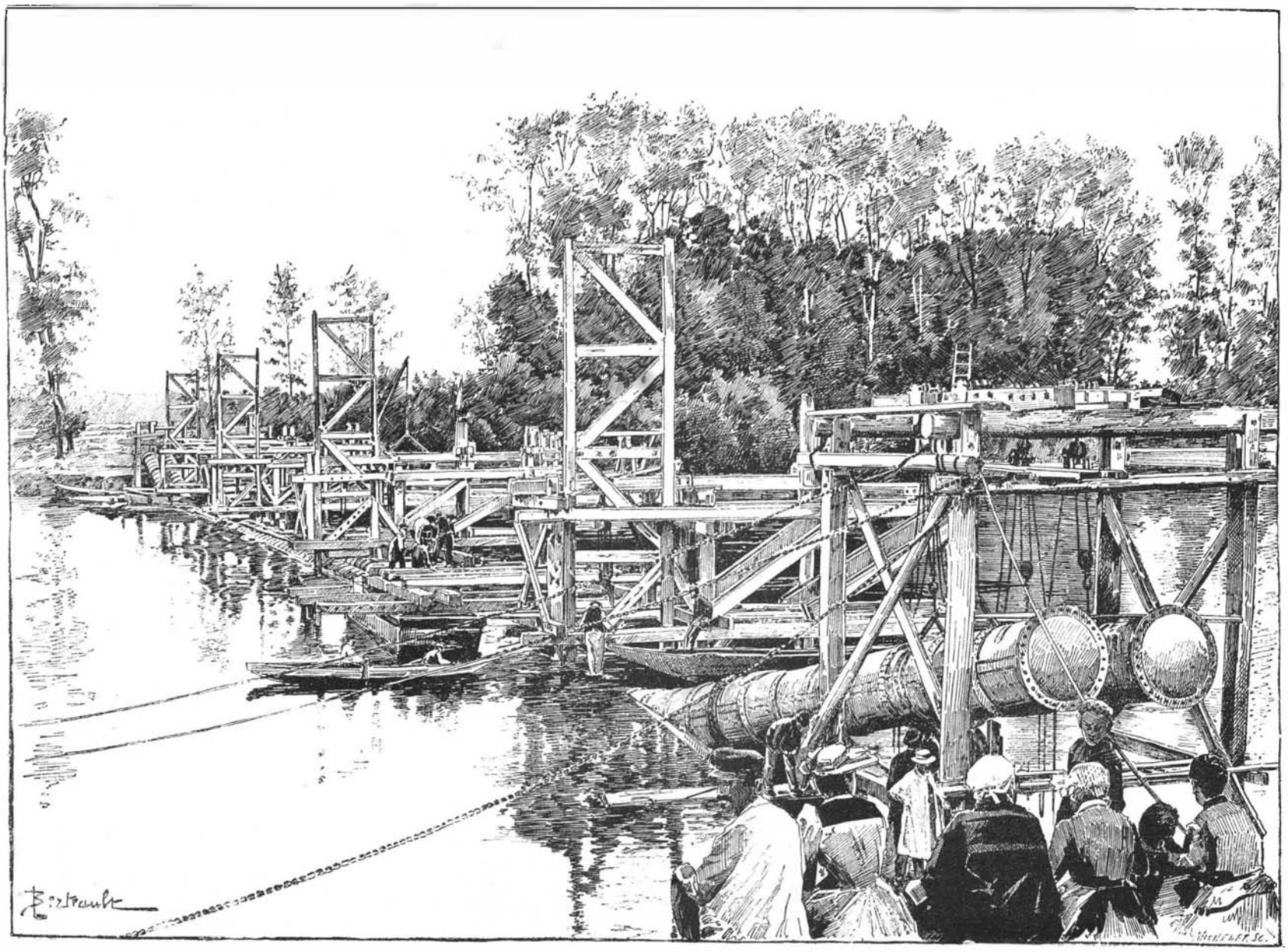
The absorbing grounds of Acheres have a surface of



MACDONALD'S PNEUMATIC VENTILATOR.

about 1,600 acres. It was a question in the first place of forcing to them the 9,504,000 cubic feet of sewage water that the Gennevilliers peninsula cannot absorb. To this effect there is under construction at the present moment a lifting plant, comprising four engines of 1,000 horse power as a whole, which will be doubled in the future when it becomes a question of the irrigation of Mery-sur-Oise and Meulon.

The sewage water, lifted to a height of 16 feet, will be forced into a siphon passing to Asnieres under the bed of the Seine, at the issue of which an aqueduct will lead it to the relay works of Colombes, near Paris. There a large plant comprising four engines and developing 6,000 horse power will lift the water to the summit of the hill of Argenteuil. Here they will empty into two conduits six feet in diameter crossing the Seine at Argenteuil upon an aqueduct bridge. Starting from Argenteuil, the sewage water will de-



PARIS SEWERAGE—SUBMERSION OF A SIPHON AT HERBLAY.

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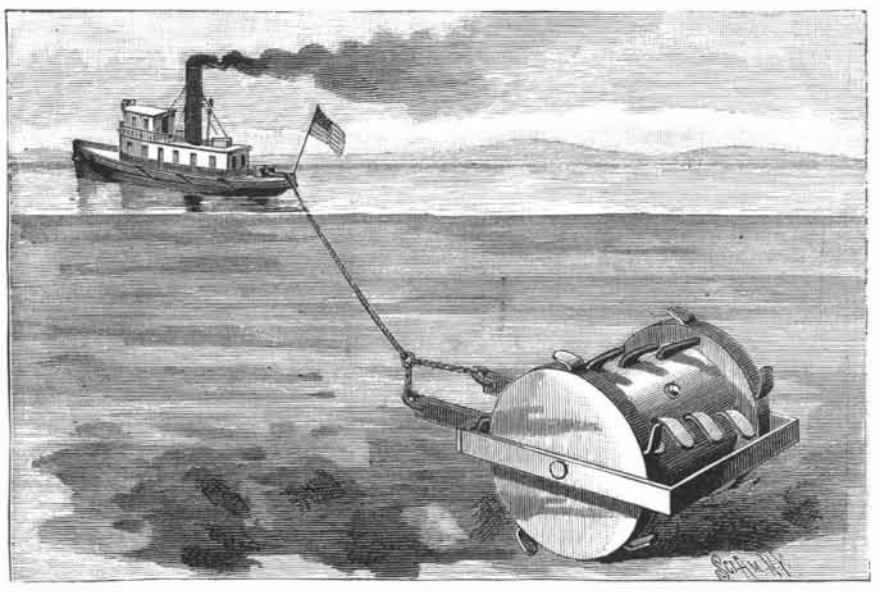
scend through a simple difference of level into a gallery 10 feet in diameter, calculated to discharge double the present production of Paris in liquid manure. It is from this gallery that branches the derivation designed to fertilize the plain of Acheres. It crosses the Seine at Herblay through a siphon, whose construction and putting in place we shall describe. This siphon, for which a series of timberpiers was previously constructed, was submerged during the first week of October.

It consists of two iron plate pipes ¾ inch in thickness, spaced externally 20 inches apart and connected at every 10 feet by interties. Each pipe consists of two oblique parts and of a straight part 520 feet in length. The total length between perpendiculars of the siphon thus constituted is 660 feet.



BENTINCK & RENNER'S DIGGING MACHINE.

A complete siphon thus constructed weighs about 250 tons, and the putting of it in place is not easy. It was necessary to effect it in an interval of only three days' stoppage of navigation. Engineer Lannay succeeded in doing it with the co-operation of Messrs. Le Blanc & Marcadet, the contractors.

Our engineers had in truth some previous analogous examples. One of the best known is the siphon of the Isle of Saint Louis, laid in September, 1890, and which empties into the great collector of the right bank of the Seine the sewage water of the left bank which was formerly thrown into the river through nine discharges opening in the two arms that encircle the island. The siphon of the Isle of Saint Louis was but 345 feet in length, and yet the laying of it furnished useful data for the execution of the special work under consideration.

The laying of the Herblay siphon was done in a transverse excavation 13 feet in width, made by a dredger in the bed of the Seine and carefully leveled with beton. The siphon was carefully let down into the excavation and the latter was then covered with beton, so that nothing should interrupt the very busy navigation going on above.

Each branch of the siphon is composed of iron plate sections connected and riveted end to end, at first in groups of four at the works, and then one to the other upon the field of operations.

Before the operation, the tubes as a whole rested upon nine timber piers planted at right angles with the bank. The two extremities having been perfectly closed with plugs, there was thus formed a true float that it sufficed to allow to glide into the water, just as a ship is launched by lifting it with jack screws.

The tubes being afloat, they were led across the river exactly in the transverse direction of the excavation previously marked out. Then they were seized between three frames forming slides and designed to guide them to the bottom. The submersion was effected by charging the two siphons with rails laid upon the cross pieces that connected the two tubes. These rails were removed by divers after the termination of the operation.

It was not until after the putting of the pipes in place that the water was allowed to enter them, for the introduction of it before this would have sufficed to sink them to the bottom, and eddies and displacements might have been produced that would have interfered with the precision of the operation.

Before the siphon was put in place, and while it was still out of water on the field of operations, it was tested in the first place at a pressure of six atmospheres, in order to make sure that it presented no leak or defect.

Such, in brief, is a description of the operation of which the accompanying engraving, from *L'Illustration*, gives the general aspect.

THE Suez Canal, the greatest work of marine engineering, is eighty-eight miles long, and reduces the distance from England to India from 11,379 miles to 7,628 miles.

A DIGGING MACHINE TO DEEPEN CHANNELS, ETC.

This machine, when submerged and dragged along the bottom of a waterway, digs into and carries up the sand, etc., permitting the raised material to be floated away by the current. It has been patented by Eliza J. Bentinck and Julia A. Renner, of Galveston, Texas.

In a suitably made frame, connected by brackets with a chain leading to a boat, or other means of pulling the machine, is journaled a shaft carrying drive wheels and a drum, both the wheels and the drum having shovels arranged about their periphery. The drum is hollow, and when empty floats upon the water, in which condition it is most easily moved to the place where the work is to be done, the device sinking on the removal of a plug, which allows the drum to fill with water. By means of a pinion on the shaft, an idler, and a gear on the inner rim of the drum, the latter is driven in a direction opposite to that in which the drive wheels travel. It is designed that the drum shall be ten feet in diameter and carry about 200 shovels, each capable of lifting about a cubic foot of material, so that each revolution of the drum will carry up some seven to eight cubic yards of sand or mud, thus rapidly and effectively deepening channels or removing sandbars at the mouths of rivers, etc.

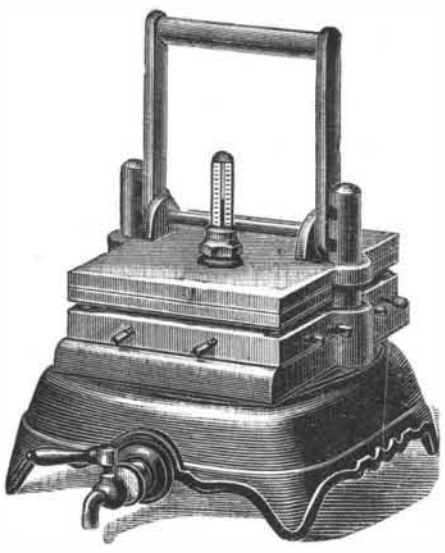
AN IMPROVED RECORDING THERMOMETER.

The instrument shown in the illustration indicates and records the slightest variations in temperature. The record is made on a paper chart carried by a disk, the chart containing fourteen divisions divided into hours for each day and night, and the disk being rotated by a fine eight-day spring clock movement. This thermometer is made with the following ranges Fahrenheit, according to the purpose for which the instrument is to be used: From 50° below zero to 80° above; from 20° below zero to 110° above; from + 70° to 200°, and from .0° to 260°. The clock is fastened to an iron frame constituting the backbone of the instrument, A being the clock arbor, C the clock box, and W W winding arbors. D is the ink pen, three or four drops of the prepared ink furnished lasting a week, and L L is the recording lever, S S being adjusting screws. On the arbor that carries the lever are two small arcs, F F, connected by fine platinum wires, P P, with the metallic thermometer strips, N N. These strips are each made according to the recognized method of two metals suitably fastened together, one of the metals expanding more than the other, and causing the compound strip to bend in one direction with an increase of temperature and in the other direction with a decrease of temperature. Being thin and long, they present a large surface to the air, and are, therefore, very sensitive to changes of temperature. X X represent the position of adjusting screws for fastening the instrument in place or in a packing box. These instruments, as manufactured, are standardized and warranted to automatically make a continuous record of temperature without error or omission, and cannot fail to prove of high value in very many places, as in theaters, churches, clubs, dwellings, hotels, hospitals, schools, asylums, greenhouses, breweries, glue works, dry kilns, thread mills, or wherever evenness of temperature is desirable and an effort is made to keep at or near a certain standard. They are especially desirable in the drying rooms of manufactories, in breweries, glass works, glue and varnish factories, etc.

Where desired, an electrical attachment is furnished in connection with the thermometer, by means of which an alarm is given at a distance when the temperature rises above or falls below a predetermined point. These instruments are manufactured by the Draper Manufacturing Company, No. 152 Front Street, New York City.

A COMBINED RUBBER STAMP VULCANIZER AND PRESS.

With the improved means shown in the illustration, the old, slow screw press movement, in making rubber stamps, is dispensed with, and the quick cutting blow of a die punch with lever movement is substituted, producing a sharper, better face on the letters of the mould, while also doing the work much more rapidly. Any kind of type, electrotypes, etc., used to print from



THE "NEW YORK" RUBBER STAMP VULCANIZER AND MATRIX PRESS.

may be moulded, giving the best results, high spaces, quads, or leads not being needed. The heat is supplied by either a kerosene or gas heater, a high temperature thermometer indicating the proper amount of heat to be applied after the raw rubber has been pressed into the mould, and the vulcanization is then effected in a few minutes. The unvulcanized rubber for making stamps is supplied in sheets about an eighth of an inch thick, as many stamps as will come together in a chase being usually made at once, to be cut apart after removal from the mould and mounted on wooden handles or self-inking frames. The advantage of a rubber stamp outfit as an adjunct to a printing office may also be a very material one, enabling rubber dies to be made from any of the kinds of type in use for the printing of jobs when the surface to be

INSTRUMENT COMPLETE.

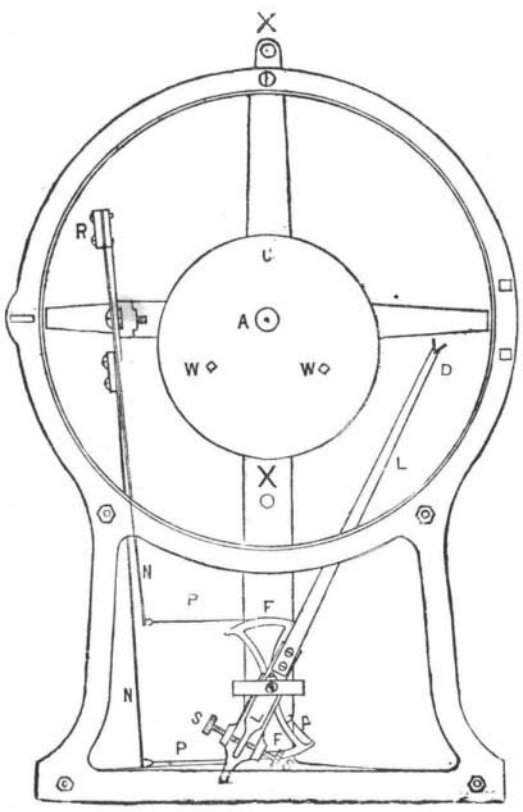


DIAGRAM SHOWING PARTS.

DRAPER'S RECORDING THERMOMETER

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printed on is rough or uneven, as envelopes, fans, etc. The rubber die or plate can be readily attached to a block of wood, or any old block on which a type plate has been previously mounted, and the job printed perfectly, with little trouble in making ready and the entire avoidance of loss from broken or damaged type. These vulcanizers are manufactured by the Barton Manufacturing Company, 336 Broadway, New York City. They received a medal and diploma at the recent World's Columbian Exposition at Chicago.

Photographic Notes.

Herr Valenta has succeeded in developing prints on ordinary albumenized paper, the exposure under the negative being reduced to about one-fifth of that usually required. It is even possible to print by electric, gas or lamp light. After printing, the paper is washed free from any nitrate of silver it may contain and developed in the following solutions:

No. 1.

Hydroquinone	10 parts.
Alcohol	100 "

No. 2.

Sodium sulphite	100 parts.
Citric acid	5 "
Water	500 "

For use take 5 parts of No. 1, 5 parts of No. 2, and 100 parts of water. The faint violet image, visible when the picture is taken from the printing frame, gradually becomes yellowish brown, and all the detail in the high lights appears when the development is complete, which takes about ten minutes. Toning of the developed print may be effected by immersion in the bath given below:

Sodium hyposulphite	200 parts.
Ammonium sulphocyanide	25 "
Alum	30 "
Acetate of lead (10 per cent solution)	40 "
Water	500 "

Heat the solution to 60 degrees C., filter, and add 50 c. c. of

Chloride of gold	1 part.
Water	60 "

Allow the prints to remain in the solution until the desired color is obtained. Ten minutes will usually be required.

A feature of the defense in the suit brought by the owners of the British steamer Winchester, in an admiralty court in London, to recover salvage from the Dutch steamer Maasdam, was the introduction of photographs taken at the time the Winchester took the Maasdam in tow. These plainly negatived the plaintiff's claim that the weather at the time was severe, and that the latter vessel was in great danger. In disputed cases of this kind the value of properly authenticated photographs in a court of law is becoming well established.

Messrs. Cross, Bevan & Beadle have recently patented a new substance, made by soaking cellulose fiber in a 15 per cent solution of caustic soda and then exposing the resulting compound to the action of carbon disulphide vapors for three hours in a closed vessel. A yellowish mass is formed, which gives a solution of great viscosity when dissolved in water, and from which it is precipitated by the addition of alcohol or salt and water. Its solubility is destroyed by heating to 90 degrees C., which converts it into a horny, structureless mass of cellulose, somewhat hygroscopic and probably suitable for a support to the sensitive photographic film. This may eventually replace celluloid. It is possible to coat a glass plate with the solution and then precipitate upon it the insoluble film by means of salt and water and subsequent heating. Any adhering chemicals are readily removed by washing.

We quote the following from a communication which we have recently received from Mr. C. T. Chesterman, of St. Petersburg, Russia: "The method of three-color printing, which has received such impetus of late, must be regarded as a decided advance on ordinary chromo-lithography in the reproduction of water color drawings, as, owing to the reduction in the number of printings necessary to obtain the end result, a mat surface is obtainable. This is not possible where twelve or more colors are superimposed, unless recourse is had to magnesia dusting, which, however, mars the effect of most colors. On the other hand, great care must be exercised in the selection of the pigments, otherwise the pictures will be far from being joys forever, as a partial fading of one color will have such a degrading effect upon the whole as to bring the process into disrepute. Where a large number of colors constitute the whole, a slight fading is hardly perceptible. Yet we see, from time to time, some sorry specimens of chromo-lithography. It behooves all those, therefore, working the three-color system of printing to thoroughly investigate the color and stability of their pigments before employing them in actual work."

We have received from Messrs. Husnik & Hausler, Prague, an excellent photo-chromotype printed in three colors. The greens are remarkably pure and bright, but the orange tones are a little too red. We have also the three separate color prints in red, green, and yellow, which, when combined, form the finished print. The original process has been perfected by this firm, who have succeeded in making the marked improvement noted in the rendition of the greens.

Dr. Schottlander has described a curious colloidal form of gold containing basic acetate of cerium, which is completely soluble in water. The solution is violet-red to carmine-red, and so intense is the color produced that 1 part in 500,000 is distinctly visible. The solution may be obtained either by precipitating a solution of cerous salt mixed with gold by means of caustic potash and dissolving the black precipitate produced in hot dilute acetic acid, or by boiling a solution containing the proper quantities of cerous acetate, gold chloride, and sodium hydrate. Sodium acetate precipitates a violet-red deposit from such a solution containing all of the gold and some of the basic cerous acetate. The precipitate, when dried, is an amorphous, bronze-colored, glittering mass, soluble in water, and bears a certain resemblance to Carey Lea's soluble silver.

According to R. E. Liesegang, negatives stained by development with para-amidophenol may be bleached by soaking them in oxalic acid and exposing them to the sunlight for two hours. A concentrated solution of sodium sulphate has a similar action, and the exposure to sunlight is unnecessary. Citrate of tin solution removes the yellow stain incident to pyro development, and citrate and acetate of tin partially bleach those stained with amidol. As both these latter agents (citrate and acetate of tin) are solvents for gelatine, considerable care must be exercised in using them.—*Anthony's Photo. Bulletin.*

Injuries to Cotton by Ginning and Packing.

It goes without saying that raw cotton is treated in a most reckless manner, not only in the gathering, but in the ginning and packing, It is well known that cotton fibers are extremely tender; the mean diameter of the fiber measures from 1·1185 up to 1·1562 of an inch, in other words it takes from 120,000,000 to 140,000,000 to weigh 7,000 grains. One fiber weighs only $\frac{1}{16000}$ *part* of a *grain*, therefore, one can readily perceive that very careful treatment is most desirable in the different processes, but, on the contrary, it meets with so much torture from the moment it blooms into maturity on the cotton plantation, all through, by submerged river boats or railway carriage, until it is dumped down on the floor of a cotton mill, that it seems as if all combined to get rid of an evil spirit. Ginned cotton when wet, or even in anything like a moist condition, proves the greatest trouble that an unfortunate carder has to contend with. It is all very well to preach patience, but not easy for a distracted man to practice it, when, after having his machinery, that has previously been giving ample satisfaction and comfort, disorganized, he finds his best efforts rendered null and void by a brand of cotton, such as we have described, *licking* up on the cylinder and otherwise baffling every attempt to deal with it. Few but those who have to suffer know the difficulties, and, of course, the carder becomes the scape-goat, until his life is scarcely worth living. This system of things has gone on from the far-away past to the present. Operatives have a very expressive *slang dictionary* of their own in which alone they can give vent to their feelings. Why should nearly a century of improvements have passed and leave us still almost where we began? What is the use of improving the carding and spinning machinery—the tail almost of the manipulation—when the head and front of the offending element are almost "improved backward"? The one word "*saw*" in connection with the initial process is quite sufficient to indicate the usage this delicate fiber receives, apart from all other loose practices. Here we have, at the very first step, the destruction of nature's gift to *cotton—the twist;* it vanishes the moment the saw is applied. On the very same principle that the twist can be rubbed out of a thread or piece of twine by friction, so is cotton fiber ill-used, torn, and cut, particularly when damp, but who cares—"sufficient for the day is the evil thereof!" "Get it away!" "Liverpool must see to it!" What care we! Let us fairly and squarely grasp the condition of things. Cotton baled damp and probably having to lie for a considerable time here and there, will, when opened, be in lumps—matted and mildewed—a precious state of fiber from which to make decent fabrics, persecuting every individual that has to handle it, sending weavers home ill, and causing the discharge of first-class finishers. It would not not be far fetched to say that *cotton in this condition just diminishes one quarter of its weight*—a very economical idea of business—paying a certain price per pound of 16 ounces and getting only 4 ounces for actual use, and if, as often is the case, the material is short in the fiber and the windows of the blowing room are accidentally opened, it will fly away to where it came from. The United States spinners and manufacturers are loud in their complaints of the rubbish, miscalled cotton, which they have to contend with, so that our grievances in this respect are not without a real foundation, but, there is no doubt, we get the worst samples.

In the packing process the fibers are seriously injured, because of the sand and trash mixed up with the cotton. The amount of compression would be of little consequence if the cotton was thoroughly cleansed previous to packing, but this point is "more honored in the breach than in the observance." Now, with many subjects, we can theorize, or grumble, and talk in public, and take to our last and favorite resource—the formation of an inquiry committee, which leads to, and ends with, the inevitable public dinner, yet the dirty, adulterated cotton arrives—the plague of our lives as operatives—just as usual. Each quality of cotton has its own peculiarity in length, fineness, etc. Now length and its continuity are the tests of the finished yarns and fabrics. As the character of the work done in carding will inevitably decide that of the ultimate production, so must the character of the work done by the machines preceding carding influence, to a great extent, this operation. If, then, the raw cotton material could be delivered to the spinner carefully gathered, dried, and picked, all the preparation before carding would be very much reduced, and costly, tedious processes might be well dispensed with.

Genius Wanted in Agriculture, Not in Weapons of Destruction.

I am exceedingly doubtful whether all of the genius exercised in agricultural implements since the displacement of the old scythe for mowing grass by hand, and the sickle for reaping and the hand flail in thrashing grain, will compare with that exercised in the production of new firearms since the old flint locks and smooth bores of our earlier days.

The percussion cap has taken the place of the flint. The revolver, the percussion cap, the repeater, the self-cocking hammer, the Sharp and Winchester rifles, and numerous breech loaders, with all of their minute and ingenious contrivances and appliances, are among the wonders of invention.

Our own Patent Office is a vast laboratory for the scientific researcher. I have frequent occasion to examine in our Patent Office for various prior inventions, and I think if there is anything of great human need that is really neglected, it is the production of new agricultural inventions. Human existence depends on agriculture. As I have journeyed over our vast domains, and those of modern Europe, France, Germany, England, where production has been more than doubled within less than a century, according to the best authorities, still they are far behind what science may yet do.

When we view the old wooden sailing vessels of the Revolution, and even those of our war of 1812, when Oliver H. Perry won his great victory on Lake Erie, when he wrote, "We've met the enemy and they are ours," and it took six weeks for it to reach Washington, our capital, and find that now a man can talk through the telephone, or send it by lightning, we see what science has done in respect to means of communication.

Now look at one of our nickel-clad armor-protected destroyers, surrounded by torpedo protectors or nets, then on the deck a wire gun screen around the gunners, woven of a wire so that the enemy can be seen through it, and yet, as has been proved, that at five paces a Minie ball, a sample of which I have in my possession, would not pierce it, and still the Winchester that threw it would pierce a five inch white oak plank at half a mile distance.

I confess that I am too much of a Quaker to study on the ways of destroying human life. I am too much of a peacemaker to rack my brain—what little I have—in trying to get up something to burn and destroy. I hope for a still higher civilization, "when nations shall have war no more;" when human genius shall be more fully employed in developing the arts of peace, and especially of agriculture, which is the foundation stone of all human industries. J. E. EMERSON.

London Pavements.

La Semaine des Constructeurs quotes from a report of Mr. Foulger, the Chief Engineer of the London Gas Company, some rather startling information about the condition of the London streets. Many of the streets are paved with wood blocks, laid on a stratum of concrete, which forms a sort of arch across the street. This concrete has become very hard, so that it is quite capable of sustaining the traffic without the support of the earth beneath it; and it seems that in course of years the soil, which is loose and soft, has settled away from beneath it, so that, for example, in Oxford Street it was found, in making some repairs, that a man could crawl in between the underside of the concrete arch forming the substratum of the pavement and the surface of the soil under it. Except for the danger of a sudden collapse of the arch, this subsidence of the soil would not be a serious matter, were it not for the fact that the space between the concrete and the soil is found to be filled with a mixture of gas, which has escaped from the street mains, and air; and if the mixture should attain explosive proportions, which might easily happen, a short-circuit of an electric current, or an incautious excavation, might result in blowing the street into the air.

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RAILROAD CONSTRUCTION IN OLD AND MODERN TIMES.

An exceedingly interesting exhibit at the World's Columbian Exhibition was contributed by the George-Mary Mining Co., of Osnabruck, Germany. This interesting collection represents different specimens of road and railroad construction, from the most primitive form of early times to the highest perfection of the modern steel rail. The articles, most of which were real samples, and some of which were in part or wholly reproductions, were taken from the Museum of Permanent Way, which is one of the institutions of Osnabruck. This museum owes its foundation to the fact that the company named above has for many years been identified with the railroad interests of the world, and had the requisite enterprise and enlightenment to organize this most interesting collection.

In point of time the earliest age of transit is represented by the plankroad (Fig. 1), the "Pontes Longi," or "long bridges," described by the Roman historian Tacitus. This exhibit is an actual piece of a road laid about the fifth year of the Christian era, by Domitius. It was 10½ miles long, over a marsh called Dievenmoor, near Osnabruck. It is now covered with six feet of peat and moss. It was excavated in 1892. It is to some extent the predecessor of our modern plank roads. It will be noticed how the planks are split out radially from the trunk. It is said that after exhumation it had to be dried in the dark to prevent it from falling to fragments.

This structure, laid on longitudinal sleepers, and not intended so much for wheeled vehicles as for horse and infantry, is followed (Fig. 2) by a primitive wooden railroad or tramway. Here we have wooden rails simply spiked down on wooden sleepers. Later improvements consisted in "gaining" the rails into the sleepers, so as to prevent spreading, and in facing the tops of the rails with a strip of hard wood easily replaceable or with a plate of iron. To a coal mine proprietor named Beaumont, of Northumberland, the construction with sleepers is attributed, in the year 1630. The example shown is from the Apostle mine, Transylvania. Simple plank laid without sleepers antedate this construction.

In England the spiking down of the plate of iron upon the wooden rails was termed "plating" the rail. Here we find the origin of the word "platelayer," still used in England to denote men who lay rails on the sleepers.

The next cut (Fig. 3) is an early example of iron railroad work, constructed by B. J. Curr, in Wales, in 1800. The rail is of angle iron section, with fish-bellied flange, and is supported at its joints on rough stones about two square feet in area and about eight inches thick. The rails were a yard long. The spikes were driven into wooden dowels set into holes drilled in the stone. This primitive road ran from Merthyr-Tydvil to Aberdare Junction. In 1804 Richard Trevithick experimented with an unsuccessful locomotive engine on this road.

The form of cast iron rail shown in Fig. 4 is of more modern section. It dates back to 1789, its constructor bearing the name of Jessop. The ends of the bottom flange were enlarged to give a better support. Each rail was between three and four feet long. This exhibit was a model, no original being obtainable.

Still keeping to stone sleepers, we see in Fig. 5 a very curious rail laid by George Stephenson for the Stockton-Darlington line in 1825. This is a forged and rolled rail, attributed, as regards its construction, to a metallurgist named Berkinshaw. It was laid on cut stone sleepers with cast iron chairs. The rail was fish-bellied between the sleepers, and had a slight foot-flange of fish-belly type. This railroad employed other kinds of rails also. It was the first line worked by locomotives. Stephenson here fastened the chairs directly by wooden treenails driven into holes drilled in the stone. The rails were fifteen feet long. A species of spike passing transversely through the web secured the rail to the chairs. This construction furnishes one of the earliest examples of the chair in railroad construction.

Next we are introduced (Fig. 6) to the transverse tie or sleeper of wood, which not only supported the rails, but also held them laterally so as to prevent spreading. We also see an early example of the fish plate. Between the wooden ties stone sleepers are seen, their use being abandoned with reluctance. The rail was spiked down by dog-headed spikes, dowels being employed for the stone sleepers. A line of this construction was laid on the Bavarian state railroad as late as 1866.

The United States supplies the example shown in the cut (Fig. 7) from the Georgia Central Railroad, referred to 1851. A series of transverse sleepers carry longitudinal sleepers which are sometimes gained into the transverse ones and sometimes rest on their upper surface. The rail of wrought iron was of rebated section, so that the head of the spike was below the tread. The sleepers of the upper and lower sets were fastened to each other by treenails. The peculiar hooked or bent plate used at the joints is indicated in the cut. Sometimes the end of the rail sprung up and pierced the floor of the car. This accident was termed a "snake-head." This system at one time was in extensive use in America.

Fig. 8 shows a rail construction used on the Great Western Railway of England under K. J. Brunel, about 1850. Here the longitudinal sleepers carry the rail. As late as 1889 there were about 1,000 miles of longitudinal sleeper construction still in use. The cross sleepers merely held the rails from spreading, a strap being used to hold the two sets of sleepers together. The peculiar section of rail with the chair securing alignment of the joints is to be noted.

In Fig. 9 we see an example of the double-headed rail from the Bombay, Baroda, and Central India Railroad, referred to the year 1852. The constructing engineer was W. Bridges Adams. The distinguishing peculiarity of this system was the use of double longitudinal sleepers, running along with the rail, and between which the rail was held by bolts passing through the web of the rail and the wood on each side. The bolts had no heads, were slotted at each end, and wedge-shaped keys were driven into the slots. Transverse sleepers were used to prevent spreading.

In Fig. 10 we have an example of German practice of the year 1838, from the Leipsic-Dresden line, in Saxony. Here we have the familiar flat base or single-head rail section held in a chair at the joints, and elsewhere resting directly on the transverse sleepers. The section differs from the modern rail in being less deep. Its foot also is wider in proportion to its other dimensions than is that of the modern rail. This is the earliest example we show of what may be termed distinctively modern practice. In the exhibit the rails and chairs were original, the other parts were supplied.

Fig. 11 is another German example, dating back to 1842, from the Breslau-Oppeln line, in Prussia. It was laid on cross ties, a very unusual arrangement with this type of rail. In the exhibit the wooden ties were not original, but had to be supplied.

In Fig. 12 we meet with a new feature, the use of cast iron sleepers. It is from the Alexandria-Cairo line in Egypt, laid by H. Greaves in 1854. The sleepers are segments of spheres or pot-shaped, made of cast iron, cast about the chair so as to make one piece with it. Double-headed rails held at the joints by fish plates, and transverse-keyed spacing bars are used. The spacing bars were distributed one on each side of the rail joint and two intermediate between the joints, giving a total of four for each rail. Seven sleepers were provided for each rail.

The iron works of the exhibiting company, the Georgmarienhutte, Hasbergen, near Osnabruck, Prussia, give us an example of modern practice (1890), shown in Fig. 13. It is an arrangement for avoiding butt joints. The rails are rolled of peculiar section, the web being at one side of the center, a distance equal to its own thickness. From the ends of the rails the foot and head are cut off as shown in the cut, leaving the thickness of the web unchanged. By laying the rails with webs to right and left alternately the scarf joint shown is secured with double thickness of web under it. The rail is of steel and it is laid on soft steel sleepers, and is held by hooked chairs and clips. Deep, angular fish plates are used at the joints.

In Fig. 14 is a sample of rail construction used on the Berlin-Stettin road in 1882. Here we have a soft steel longitudinal sleeper, with rail clamped to its top. At the joints a fish plate was used which clamped both rail and sleeper.

In Fig. 15 we have a saddle or self-supporting rail, laid on the Great Western road in England in 1855. The joints were secured by riveted fish plates. This is interesting as being the first road laid without sleepers.

Fig. 16 exhibits one of the last examples of Continental design (Germany) for countries where wood is abundant. The rail shown in Fig. 13 is used for this, but is canted inward to resist overturning strains.

In Fig. 17 we see the principle of Fig. 13 applied to a broad-footed rail, to be laid without sleepers. This is one of the heaviest rails in the world, weighing 127 pounds to the yard.

Fig. 18 shows a similar construction which has already had ten years' use on German lines. Twenty dollars per year is allowed as the maintenance expense. Here a compound rail is employed instead of the single one of ordinary construction.

Figs. 19 and 20 show, finally, rail systems for use in city streets. Here we see the usual single rail system departed from. Although they present examples of practice foreign to American ideas, they have been extensively used in Germany and elsewhere. The sections are self-explanatory.

This exhibit, but a few of whose salient features we have had room to present, was one of the most interesting at Chicago. Most of these exhibits were described at length in Haarman's great monograph on railroad construction. To Haarman's invention are due in whole or part the constructions shown in Figs. 13, 14, 17, 18 and 19.

THE theodolite was first constructed in the seventeenth century, by an unknown inventor.

Correspondence.

The Chinese in Oregon.

To the Editor of the Scientific American:

The article published in your paper headed "Common Sense on Chinese and Other Immigration" should be widely circulated for the benefit of the moon-struck country that passed the senseless and brutal Geary act.

It can be clearly shown that Chinese immigration has been a direct benefit to this coast, and that both California and Oregon would be years behind in their development had it not been for this labor, available when none other was to be had. Nor has white labor been degraded by it. The Chinese laborer, forming the lowest stratum of social organization, has always been the servant. Many illustrations suggest themselves, but one or two will do. In the personal knowledge of the writer, twenty years ago fresh vegetables could not be bought in our cities and towns in Oregon at any reasonable price; now they are abundant and cheap. The Chinaman made his little gardens in neglected corners, and for years, and even now, supplies our working population. When the city council of Portland, a short time ago, attempted to license and tax this occupation out of existence, the effort failed utterly before the indignant remonstrances of our citizens. The Chinese pack the salmon in our canneries; no other labor has been commercially available for this purpose, and the industry would have failed without it. The salmon canneries give employment to thousands of white laborers, as fishermen, boat tenders, engineers, etc., etc. Stop the canneries, and this market for white labor fails, the demand for canning material fails, and the flow of the millions of foreign capital that are paid for its products fails also. Nor do the Chinamen take more money out of the country than they bring in.

In mining the Chinamen work claims that no white man would touch. They take out of the soil, for instance, three dollars per day to the man. Their expenses per man for food supplies, powder, boots, hydraulic apparatus, etc., carefully computed, cannot be less than $2.50 per day, so that if all this profit went back to China, our country would still be the gainer in the proportion of $2.50 to $0.50 in fresh gold put directly into its circulation. The Chinese clear land that otherwise would remain uncultivated for from $10 to $30 per acre; this cleared land gives employment to farm hands, and annually brings in from foreign parts the money that is paid for the wheat raised upon it, while the margin of profit to the Chinese laborer available to send to China is almost too small to be seriously considered. And finally for the political bugbear of the terrible Mongolian invasion that threatens to sweep American civilization into the Atlantic. Forty years' experience upon the coast has demonstrated the fact that white labor has only to fear its own competition. Ten years ago, when our white population was much less than it now is and our Chinese population much larger, wages were much higher and work was easier to get than it has been for several years past.

There is no doubt that the sentiment upon this coast is against the Chinese, as it would naturally be against any weak race under similar circumstances, but it is a good deal political talk. if the President, for instance, under the Geary act, had ordered the arrest of our Chinese salmon packers last summer, he would have heard a voice from this coast that would have surprised him, and the astonishing spectacle would have been presented to our Eastern friends of mobs of fishermen and other laborers upon the Pacific coast clamoring against the deportation of the Chinese.

A laboring friend of mine who hailed from somewhere near Ireland, and who rented some old buildings in Portland, which he could not rent to any one else, to Chinamen for an extravagant figure, once confided to me that while he carried a transparency in a political procession stating that the Chinese must go, it did not apply to his Chinamen, and, in fact, was not meant any more seriously than political declarations generally are.

If we only had good general immigration laws, the Chinese question might be safely left to care for itself.

THOS. N. STRONG.

Portland, Oregon, Nov. 21, 1893.

Car Fenders Required in Baltimore.

The city authorities of Baltimore have passed an ordinance which requires that all city passenger railway companies, which are now using the streets of Baltimore for the carrying of passengers, or which may hereafter be granted this privilege, shall place in front of every car operated singly, and upon the first car of any train of cars, a proper guard or fender, to prevent (as far as such guard or fender may make such prevention possible) accidents to persons or animals. The fender is to be applied within three months. Five dollars a day fine for each car not so provided. An effective fender is an invention greatly needed on every street car in this country. Here is an opportunity for inventors.

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THE MONT BLANC OBSERVATORY.

It is useless to insist upon the importance of mountain observatories. The stations of the upper regions have a clear sky, of a perfect transparency, that singularly facilitates the observation of the stars. They are situated, besides, at the very origin of atmospheric phenomena, and offer to the meteorologist as well as to the astronomer the most valuable elements of study.

One of our most illustrious scientists, Mr. Janssen, who has given an example of his ardor for science on numerous occasions, resolved to give France the highest observatory in the world, and, despite the difficulties that the ascent of Mont Blanc presents, to erect a station at the summit of the giant of the Alps. We have kept our readers informed as to Mr. Janssen's preparatory expeditions, and we have spoken to them about the soundings made in the snow at the very summit of the mountain, in order to find a rock basis to serve as a foundation for a solid structure. No rocks were found. Mr. Janssen, without being discouraged, resolved to plant in the snow a wooden observatory, whose parts should be carried up the mountain and put together at the summit.

From the very beginning of his labors, Mr. Janssen was of the opinion that it would be impossible to place the observatory upon the hard and compact snow of the summit. This idea was impressed upon him as the result of a reading of the narratives of the ascents of the last century. The intrepid De Saussure found that the small rocks situated near the summit emerged about the same as they did a century ago. It was therefore evident that the depth of the snow toward the summit and the configuration of the latter itself merely undergoes changes that must oscillate around a mean position of equilibrium.

Doubtless secular changes may occur analogous to those presented by the glaciers themselves, but such changes will, by their very nature, be extremely slow, and, consequently, little to be feared.

An experimental structure having stood upon the summit of Mont Blanc for a whole winter, Mr. Janssen decided to pursue his work. He constructed at Meudon, on the grounds of the observatory of physical astronomy, the structure shown in Fig. 1, and which constitutes the observatory. This was taken apart and carried to Chamounix by rail, after which it was carried, piece by piece, to the summit of the mountain, where it was reconstructed in the snow.

We reproduce herewith a portion of the interesting narrative addressed by the eminent astronomer to the Academy of Sciences:

Starting from Chamounix on Friday, September the 8th, at seven o'clock in the morning, we reached the summit on Monday, September the 11th, at half past two in the afternoon. The observatory stood before us. This structure consists of two stories, the framework of which, formed of wide and massive beams, crossed in all directions, in order to assure the rigidity of the whole, produced a deep impression. It may be asked how it could have been carried up to and built at such an altitude, and especially how one could have dared to found it upon the snow. Yet, if we attentively examine the conditions offered by the latter, which is so hard, so permanent and so slightly movable at the summit, we shall find on one hand that it is capable of supporting a great weight, and, on another, that it but slowly causes changes that necessitate a righting of the structure seated upon it. Upon my arrival, I devoted myself to a brief inspection. I found that the structure had not been sunk in the snow to as great a depth as I had demanded of the contractors, and this did not meet with my approval. My guides and I then took possession of one of the chambers of the observatory—the largest one of the lower floor. I had in the first place had the instruments brought up, so as to be able to begin observations immediately. The provisions remained at Rocher Rouge—a circumstance that for the moment embarrassed us. The weather having suddenly become bad, we remained separated from our food supply for two days. The storm lasted from Tuesday to Thursday morning. Then the weather became fine and I was able to begin observations. The main object of the latter was the question of the presence of oxygen in the solar atmosphere.

As known to the Academy, I touched upon this question in my ascents of the Grands-Mulets (3,050 meters) in 1888, and at the observatory of Mr. Vallot in 1890. But what constitutes the novelty of the observations of 1893 is, in part, that they were made at the very summit of Mont Blanc, and especially that the instrument employed was infinitely superior

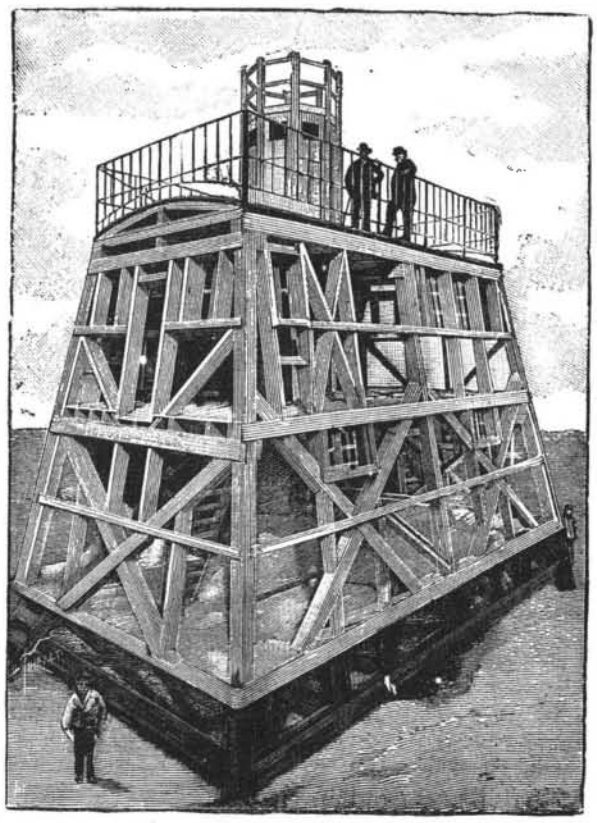


Fig. 1.—FRAMEWORK OF THE JANSSEN OBSERVATORY MOUNTED UPON THE SNOW AT THE SUMMIT OF MONT BLANC.

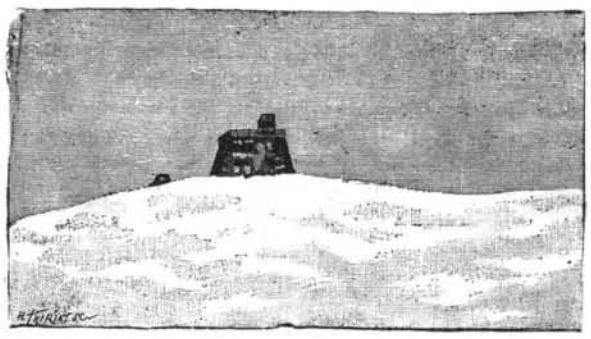


Fig. 2.—THE OBSERVATORY BURIED IN THE SNOW.

to that of the two preceding ascensions. The first, in fact, was a Duboscq spectroscope, incapable of separating the group B into distinct lines, while the instrument that has just been employed at the summit of Mont Blanc is a Rowland spectroscope (that I owe to his friendship) with telescopes of 0·75 m. focal distance, giving all the details known of the group B.

After enumerating the details of his observations, Mr. Janssen adds:

Upon the whole, I would say that the observations that have just been made at the summit of Mont Blanc permit of giving, in the study of this question of purely telluric origin, groups of oxygen in the solar spectrum and new and much more precise bases, and that they lead to the conclusions already enunciated. Independently of such observations, I devoted my attention to the qualities of the atmospheric transparency of this nearly unique station and to the atmospheric phenomena that are embraced in so great an extent and through so considerable a thickness.

The observatory is, of course, not finished. There still remains much to be done aside from the internal arrangements and the mounting of the instruments. But the great difficulty is conquered. We are under shelter for working, and have no longer to contend with snow storms. The rest will come in its time. I hope that the observatory will soon be able to allow of a more comfortable sojourn than the one that I made there. However this may be, I regret nothing. I ardently wished to see our work in place, and more ardently still to inaugurate it by some observations that I have at heart. I am happy that, despite a few inconveniences, it was permitted me to realize them.

The structure at the summit of Mont Blanc is a two story one, with terrace and balcony. The whole forms a truncated pyramid, whose rectilinear base is sunk in the hard snow. This base is 10 meters in length by 5 in width. The rooms of the basement are lighted by wide and low windows, situated above the snow. The upper story serves for the observations. A spiral stairway runs to the top of the edifice and even to several meters above the terrace, where it supports a small platform designed for meteorological observations.

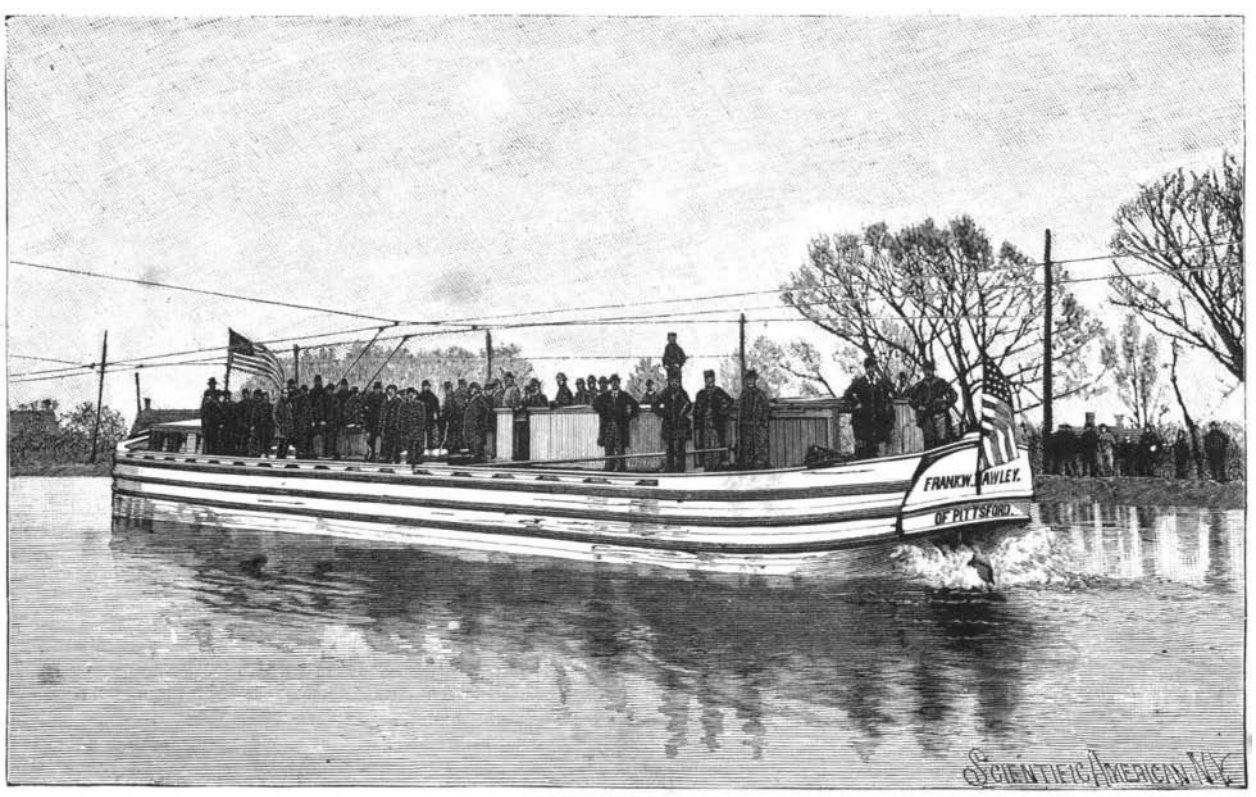
The entire observatory has double walls, for the protection of the observers against the cold. The windows and openings also are double, and, besides, are provided externally with shutters closing hermetically.

The lower part of the observatory has a double floor and a system of traps that permit of reaching the snow that supports the observatory and of manipulating the jack screws that are capable of restoring verticality to the structure in case of an inclination. The observatory will be provided with petroleum heating apparatus and all the movable objects necessary for living at such an altitude.

Such is the history of the memorable inauguration of this fine work, which is assuredly destined to furnish astronomical and meteorological science with the newest and most fecund studies.

We reproduce in Fig. 2 a view of the finished structure as it appears half buried in the snow. It forms above the extreme surface of the giant of the Alps a true house which terminates in a terrace and a pavilion. Alongside of the observatory may still be seen the little hut that was constructed two years ago. We have already said that some preliminary experiments upon the resistance of packed snow encouraged Mr. Janssen to undertake the construction of this important edifice. The learned astronomer had assured himself by numerous experiments that there was nothing impracticable in it. It is well to recall the fact that the idea of establishing an observatory at the summit had been rejected by everybody, by reason of the general belief that the summit had rejected all the objects that had been placed upon it.

In the arrangement of the structure, Mr. Janssen was assisted by his friend Mr. Vaudremer, architect of the Academy of Fine Arts, who had fully accepted the ideas of the foundation on the snow. It now only remains to proceed to arrange the interior and put the instruments in place. This will be the work of next year, as will be also the erection of the astronomical portion.—*La Nature.*



TRIAL OF ELECTRIC TROLLEY SYSTEM ON THE ERIE CANAL.

ELECTRIC PROPULSION OF CANAL BOATS.

The application of the trolley line to the propulsion of canal boats was recently the subject of an experiment upon the Erie Canal under the auspices of the government of the State of New York. The plan tried was that submitted by the Westinghouse Electric Company, of Pittsburg, Pa., and the results obtained were most satisfactory.

A section a mile long of a canal level east of Brighton, near Rochester, N. Y., was selected for the experiment. Work was begun on November 13, and on November 17 the span wires and trolley wires

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were in position and the boat was ready for the experiment. A canal boat, rechristened the Frank W. Hawley, was fitted with Westinghouse motors. A double line of trolley wires was used and the boat carried two trolley poles, thus working without grounding. The switchboard was located near the helm. The Rochester Railway Company supplied the electric power. The Niagara Power Company was interested jointly with the Westinghouse Company in the trial, and the name of the boat was that of the representative of the Niagara Company, which may have much to do in the near future with canal transit. On Friday, November 17, a private trial was made with success. On Saturday the official trial took place.

Governor Flower and a large party of guests and representatives of the interests concerned were on the boat. To the executive was assigned the turning of the motor switch. On his doing so the motor started and the propeller began to churn up the water. The boat started off and in a few minutes was moving along at about four miles an hour. Curves and a bridge were passed without trouble and a lock was entered. The boat was loaded with sand ballast and her deck was crowded with people. A strong head wind and a head current were encountered.

Other causes also did much to interfere with a successful issue. The Rochester Railway Company failed in maintaining enough voltage. The pressure given was from 200 to 250 volts instead of 500 volts, as it should have been. Under this pressure, 60 amperes of current were taken, so that about 15,000 watts at the most were absorbed, indicating about 20 horse power. The boat was an everyday canal boat, with an old type propeller. Its preparation for the trial consisted in the removal of its boiler and engine, and the introduction of two Westinghouse street car motors. Each was of 25 horse power, and the two motors were connected directly to the propeller shaft. Under the circumstances the experiment was a very great success.

The trolley line was of No. 0 wire. The lines were about five feet apart, and were strung about two-thirds of the width of the canal from the berm bank or tow-path. The trolleys were regular street-car trolleys. It is proposed to use a trolley running on the wire and connected by a flexible conductor with the boat, so as to permit the craft to be steered in any direction. Under the present arrangement the trolley lines have to be followed within the limits of a small lateral deviation.

Much expense it is hoped can be saved by this use of electricity. The maintenance of the Erie Canal costs the State of New York almost $1,000,000 per annum, of which the greater part is devoted to the tow-path. The abolition of the tow-path would save in this item a good deal of money. By increased average speed it is believed that the capacity of the canal can be doubled or trebled, while material reduction can surely be made in the help required to run a boat.

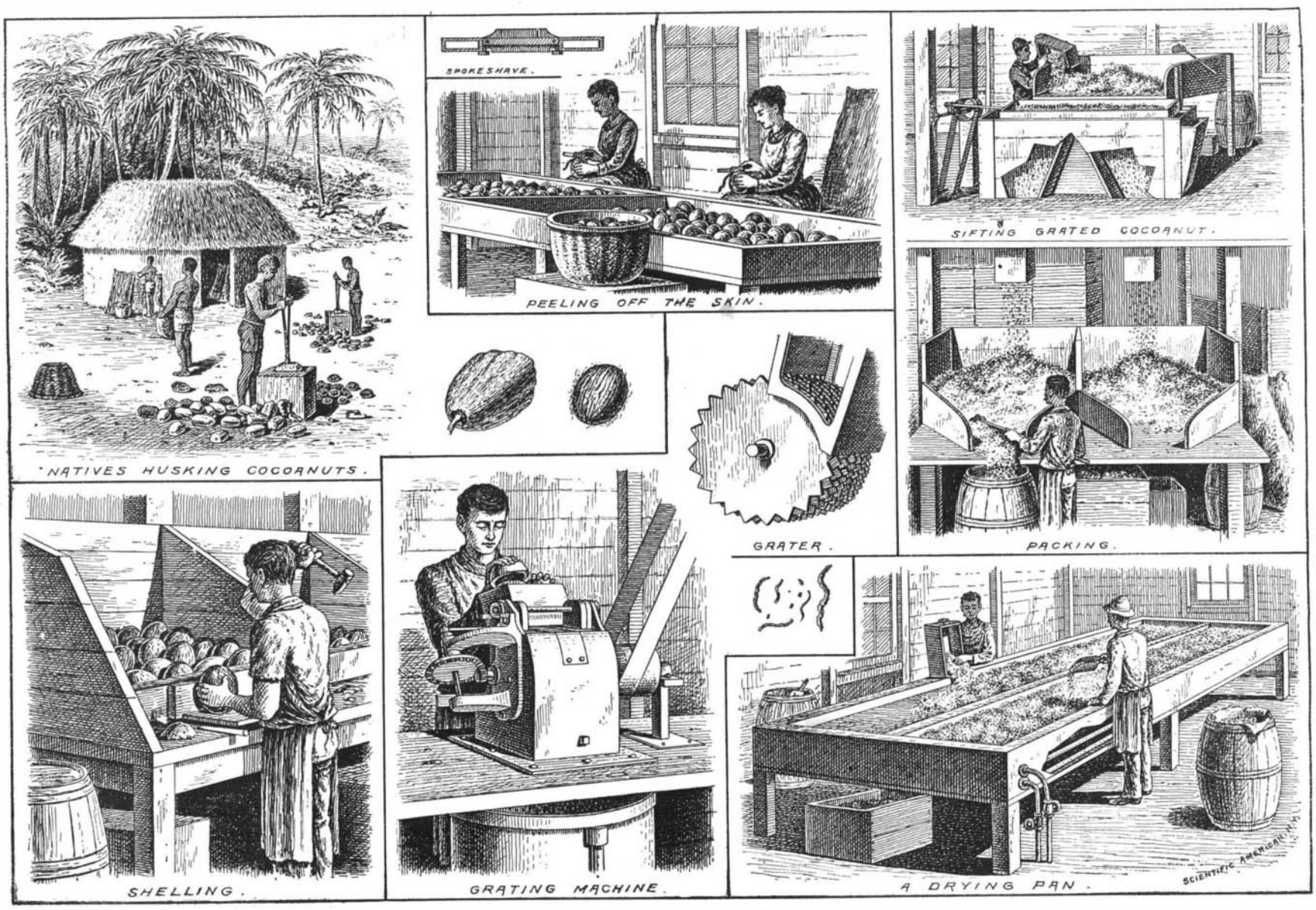
The trial is due to Governor Flower. He secured an appropriation of $10,000 from the State legislature for the purpose. The experiment cost about $5,000, and its cost was divided between the State and the Westinghouse Company.

THE MANUFACTURE OF DESICCATED COCOANUT.

The cocoanuts which are used in this country for the manufacture of confectionery, oil, etc., come principally from the West Indies. They thrive best on or near the coast. The cocoanut palm is a beautiful and lofty tree, growing sometimes to a height of 60 to 100 feet, with a cylindrical stem, which attains a thickness of about two feet. The tree terminates in a crown of graceful waving pinnate leaves. The leaf, which is about 20 feet in length, consists of a strong midrib, from which a number of long acute leaflets spring, giving the whole the appearance of a gigantic feather. The fruits mature in bunches of from 10 to 20. The fruits, when mature, are oblong and triangular in cross section, measuring from 12 to 18 inches in length and 6 to 8 inches in diameter. The fruit consists of a thick external husk or skin of a fibrous structure, within which is the ordinary cocoanut of commerce. The nut has a very hard wooden shell inclosing the kernel, within which is a milky fluid called cocoanut milk. The natives in Ceylon raise these palms in vast numbers, the ground being peculiarly suited for that purpose. It is estimated that as many as 20,000,000 of these trees flourish there. In planting the ripe nuts are placed in squares containing about 400 each. About an inch of sand or seaweed is covered over them and watered daily till they germinate. The nuts put down in April are sufficiently grown to be planted before the rains of September begin. They are then set out in holes 3 feet in depth and 20 to 30 feet apart. The roots of the young plants are first covered up with soft mud or seaweed, and for two years watered and protected from the glare of the sun. The palm begins to bear fruit from the fifth to the seventh year of its age, each stock carrying from 5 to 30 nuts, the tree bearing on an average 60 nuts yearly. The husk yields the coir fiber, which is used in the manufacture of rope, cordage, brushes, etc. The nuts are husked by the natives. They are first placed on blocks of wood and an instrument similar to a pair of shears is jabbed into the husk, the handles or arms are then opened, which tears the husk apart so that the nut can be taken out.

The cocoanuts come to this country packed in burlap bags, containing about one hundred nuts, weighing about 160 lb., and are sold from the dock or vessel at $30 to $60 per thousand.

The first operation in the manufacture of desiccated cocoanut is shelling. This is done by standing the nut on one end and striking the other with a hammer, which cracks the shell and kernel at the same time and lets out the milk. The attendant then takes an oyster knife and separates the outer shell from the kernel, which is then passed along to the peelers. An expert can shell as many as 3,000 per day. The peeling operation is done mostly by girls. The kernel is held in an upright position on the knee of the operator; starting at the top with a knife or spokeshave, it is drawn downward, taking off the dark skin from top to bottom in one stroke. This operation is repeated, the kernel being turned with the hand at every stroke until every particle of skin has disappeared. A first-class hand can peel as many as 1,800 per day. The kernels are then cut into halves and put through the grating machine. The kernels are first placed into a movable hopper at the top of the machine, which, when in motion, moves back and forth, drawing the material across a number of circular revolving knives, similar to those of a saw, which cut or grate the kernels into fine particles. The knives are about 9 inches in diameter, ⅛ inch thick, with twenty-two teeth about ¾ inch in length. The knives are set about ¼ inch part. The graters, when working steady, can grate as many as 7,000 cocoanuts per day. After grating, the material is taken to the drying room, where it is placed in heated galvanized iron pans. The tables containing the pans are 20 feet in length and about 7 feet in width.



THE MANUFACTURE OF DESICCATED COCOANUT.

Each table contains two pans 3 feet in width and about 5 inches in depth. Inclosed underneath these pans are nine double rows of steam pipes, which run back and forth the length of table. About seventy pounds of the grated material is placed in each pan, and from eight to thirty pounds of granulated sugar is added. The steam is then turned on, which heats the pans, melting the sugar, which, in turn, adheres to the grated cocoanut, the attendant occasionally mixing and turning over the material, so that the melted sugar can freely mix with it. After drying twelve hours, it is passed through a sieve, which separates the coarse from the fine material, and then packed into boxes and barrels. Thirteen hands can turn out from twenty to twenty-five barrels per day. Twenty-five horse power engine with eighty pounds of steam is used in running several graters and furnishing steam for heating twenty-four drying pans. The sketches were taken from the plant of Bussing & Graef, Jersey City.

THE Simplon road, from Switzerland to Italy, was built by Napoleon's engineers, in 1807; over forty thousand workmen were employed at one time.

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The Howell Torpedo.*

Captain Sampson, Chief of the Naval Bureau of Ordnance, has received the report of the board appointed to conduct the trials of the Howell torpedo, at the Newport Torpedo Station. The report is elaborate, and gives the result of the trials in detail. The torpedoes were subjected, of course, to test under the full requirements of the contract. After a careful inspection, they were tried from a stationary platform and then from a vessel under way.

The torpedoes were required to run four hundred yards and maintain a speed of twenty-two and a half knots during that distance. The results of the tests were very satisfactory. Twenty-five knots was the maximum speed developed, while the minimum speed was twenty-two knots. Of the eighty-eight runs made there were but three which could be classed as mishaps, one being a misfire and the other two dives to the bottom. The report states that the regulating mechanism worked well, and the contract requirements as regards accuracy were fulfilled.

The torpedo boat Stiletto did not exceed a speed of fifteen knots during the trial. This, the board reports, was due to two reasons: First, the extent of the basin was too limited to permit attaining full speed without a turn shortly before launching, during which the rudder effect slowed the boat materially; second, the demands of the motor on the steam supply operated to slow the engine. This last reason was not so apparent exhausting into the atmosphere as in exhausting into the condenser. The added efficiency of the draught when exhausting into the smoke pipe probably made up for the increased demand on the steam supply. The report states that in order to maintain the speed of the boat while the torpedoes are being spun up it will be necessary to increase the capacity of both boiler and condenser above that of normal requirements. Atmospheric exhaust obviously cannot be used, on account of noise and the formation of vapor clouds which would show plainly in the beams of a search light.

The board reports that the present motor used by the contractors gives the required speed to the wheel in from 2 to 2·5 minutes, with 130 pounds effective steam pressure. It has not, however, sufficient power to fulfill the contract requirement as to time of spinning up with any available steam pressure. The motor cannot be heard under conditions favorable to the transmission of sound until within a distance of 400 yards.—*Army and Navy Journal.*

The Uses of Carborundum.

From the experiences of the Carborundum Company this crystallized carbide of silicon can be produced at the rate of 150 pounds on the average in a day of 24 hours. The cost of the production is found to be not more than half as much as that of mining and preparing corundum. In order to purify the crude product as it comes from the furnace, after preliminary crushing to remove extraneous matters, the partially separated crystals are put into stone tanks and treated with dilute sulphuric acid to remove all traces of iron, which is deterimental in the subsequent firing to which the product is subjected during its manufacture into grinding wheels.

The chief use to which carborundum can be put is to abrasion purposes. The extent to which emery wheels are employed in factories, mills, and shops has grown most astonishingly, and it is intended that carborundum should in a large measure supplant the use of emery wheels, on account of its higher efficiency. It has been found that twice as much work can be accomplished by a brass valve grinder with ⅛ oz. of carborundum in one day than could be accomplished with any amount of emery. Against this there must be set the great difference in price between the two articles, and also the economy of the workman, as a careless man would waste too much to make the use of carborundum possible.

For glass cutting, tests have shown that the same amount of work can be accomplished in one-quarter the time that it could be accomplished with emery, and a saving of labor amounting to 25 per cent can be effected when working on hard steel or chilled iron. As a substitute for diamond dust in polishing diamonds, carborundum has been successfully tried. A new lap, and therefore absolutely free from diamond powder, was fed with carborundum powder, and in twenty minutes restored the facet of a damaged diamond, much to the surprise of the skeptical operator. It is at present used in three diamond polishing establishments in New York, though it is not as efficient as diamond powder for the first cutting and facing of rough diamonds. Although a compound bearing the formula SiC has been independently prepared by Schutzenberger, no mention is made of its being prepared in a crystalline form, which is one of the chief features of carborundum. In addition to this it transpires that the date of Schutzenberger's communication to the Academy des Sciences is three months later than the date on which Nicola Tesla exhibited a lamp fitted with a carborundum button; which constitutes another use to which this compound has been put. The application of its properties of infusibility and incombustibility have yet to be further developed.—*Chem. Tr. Jour.*

* The Howell torpedo was fully illustrated in the SCIENTIFIC AMERICAN for October 20, 1888.

The Cereal Crops of the World.

An attempt has been made by the United States Department of Agriculture to afford a trustworthy view of the production and distribution of the principal agricultural crops of the world. Ninety-two countries are represented in the work, and the period embraces ten consecutive years wherever annual statistics are available. It is claimed, and no doubt correctly, that never before has there been "so comprehensive and complete a collection as to extent of geographical area represented and continuity of annual statements." The subjoined details refer to the chief cereal crops, excluding rice:

ESTIMATED ANNUAL AVERAGE YIELD OF THE CEREAL CROPS OF THE WORLD.

	Bushels.
Oats	2,328,000,000
Corn	2,300,000,000
Wheat	2,281,000,000
Rye	1,317,803,000
Barley	802,000,000

Europe and North America grow most of the oats produced in the world, while Australasia raises a considerable quantity for her own consumption. In the bulk annually produced the United States takes the lead, being followed in order by Russia, Germany, and France. The world's trade is confined chiefly to exchanges among European countries, the foreign trade of other nations being comparatively small.

Of the world's corn crop, 80 per cent is produced in the United States alone, while the great crop of 1891 in that country was almost equal to the average annual crop of the world. The average annual net importation into Europe appears to be about 64,000,000 bushels. The average annual net exportation from the United States is about 57,000,000 bushels, of which Canada takes 2,000,000 bushels. This leaves a balance of 9,000,000 bushels to be made up for Europe, and it is supplied from the Argentine Republic. Only four European countries export corn—Russia, Roumania, Bulgaria, and Servia—and of these the two last named are unimportant. Russia and Roumania ship about one-half of their total product of corn. Notwithstanding the vast exportations from the United States, they yet represent less than 4 per cent of the total annual production of that country.

The wheat "market of the world" is practically all within Europe, and even here is limited to the necessities of a few countries. "Insular and factory-studded Great Britain," with its small area and its teeming population, and populous little Belgium furnish in effect the market for which the wheat growers of the world are striving in competition. Outside England and Belgium, Europe may be regarded as self-supporting, the excess in the eastern countries of Europe being sufficient to cover the deficiencies in the western. It should be mentioned that, according to a consular report published recently, the Argentine Republic is rapidly acquiring a prominent position as a wheat-exporting county. In the year ended June 30, 1892, the Argentine Republic exported 13,500,000 bushels, while in the year ended June 30, 1893, the corresponding quantity was 26,000,000 bushels, large quantities of wheat being at the same time held back for considerations connected with the currency. A dozen years ago the Argentine Republic was producing barely enough for its own consumption. The area which it is there possible to place under this crop is capable of enormous extension.

Excepting in European countries, rye is of minor importance. In many parts of the Continent it furnishes the bread of the people, and in such countries the production and consumption of rye exceed those of wheat.

Russia has the credit of the largest output, her annual production averaging upward of 700,000,000 bushels, a cereal crop which is exceeded only by the corn crop of the United States. Germany, with an average crop of 228,000,000 bushels, stands next to Russia, and is followed by Austria-Hungary with a crop of 122,000,000 bushels. Inasmuch as the areas of production and consumption are almost identical, rye does not figure in international trade to an extent proportionate to its importance as a crop. Germany is the largest importing country, but she purchases only 30,000,000 bushels per annum, while Russia, the greatest exporting country, does not ship more than 46,000,000 bushels of rye grain. The only extra-European countries in which rye may be regarded as an important crop are the United States and Japan. In the former country the annual product is about 25,000,000 bushels. Deducting from this the net exportation of 2,000,000 bushels, there are left some 23,000,000 bushels for home use, a quantity equivalent to a little over one-third of a bushel for each head of the population.

While barley is a prominent crop in Europe and Canada, and an important one in Japan, it only ranks as one of the minor cereal crops in the United States and Australasia. In Europe, Russia is the largest producer, followed in order by Germany, Austria-Hungary, and the United Kingdom. Though barley is regarded as a minor cereal in the United States, yet only four countries in the world produce an absolutely larger crop. The decennial average puts the United States crop at 55,000,000 bushels, but of late years it has been steadily increasing. It is the only cereal which is not produced to a sufficient extent in the United States to meet the requirements of home consumption, the average net imports for ten years having reached about 10,000,000 bushels annually.

The exports of wheat flour from the United States exceed the net exports of flour of all kinds from all other surplus countries. Austria-Hungary and Germany rank next in flour-exporting capacity. The great market for flour is found in the United Kingdom which has an annual average importation of 1,660,000,000 lb. of wheat flour, the product of about 38,000,000 bushels of wheat grain. The total net exports of the manufactured article from the United States represent about 42,000,000 bushels of wheat grain.

Impressions with Modeling Compound.

I have made the subject of taking impressions with modeling compound a special study for a number of years, until I have fully satisfied myself that there is no longer a place, or even an excuse, for the use of plaster for taking impressions under any circumstances. But within the last twelve months I have discovered a new use for the compound, which I think will be greatly appreciated by all who are doing crown and bridge work. I know most men imagine they get a very good adaptation of bands under the free margin of the gum, but it would surprise any one who will first adapt the band to the root in the mouth as is usually done, then take an impression of the root (as I do) and get a metal cast and try them, and see how far from an adaptation it is. The way I proceed is thus: Take No. 3 modeling compound, or No. 2 that has been used a few times, and with Mellott's No. 20 impression cup, with the bottom cut out so as to insert a finger, proceed to take an impression. Trim your root to the proper shape, and if there is a tooth on each side, place a small piece of celluloid (a piece of collar, for instance) between the root and the tooth or teeth; then fill the cup level full with the heated compound and press to place; with ice water cool the outer edges, and then, still holding the cup steady, press the compound in the center of cup with the finger or a round instrument; cool thoroughly with ice water; then withdraw, and you have a perfect impression of the root as far up as the free margin of the gum extends. Now dip the impression in ice water, have some Mellott's metal ready, wipe the impression perfectly dry and dust with soap stone, slip on rubber ring and pour metal as cold as it will flow. Have a syringe full of ice water ready, and as soon as the metal is poured throw on ice water with syringe till you can drop it into ice water, when you will find you have the most perfect metal cast that can be made. You can then adapt your crown or band to the cast so that when adjusted it will be the most complete adaptation, and so do away with annoyance and pain to the patient.—*Staples (G. S.), Western Dental Journal.*

The Discoveries of Scheele.

Professor T. E. Thorpe contributes a paper to the *Fortnightly Review* on Carl Wilhelm Scheele, whose life's work is summed up as follows:

"We owe to Scheele our first knowledge of chlorine and of the individuality of manganese and baryta. He was an independent discoverer of oxygen, ammonia, and hydrochloric acid gas. He discovered also hydrofluoric, nitrosulphonic, molybdic, tungstic, and arsenic acids among the inorganic acids; and lactic, gallic, pyrogallic, oxalic, citric, tartaric, malic, mucic, and uric among the organic acids. He isolated glycerin and milk sugar; determined the nature of microcosmic salt, borax, and Prussian blue, and prepared hydrocyanic acid. He demonstrated that plumbago is nothing but carbon associated with more or less iron, and that the black powder left on solution of cast iron in mineral acids is essentially the same substance. He ascertained the chemical nature of sulphureted hydrogen, discovered arseneted hydrogen and the green arsenical pigment which is associated with his name. He invented new processes for preparing ether, powder of algaroth, phosphorus, calomel, and *magnesia alba*. His services to quantitative chemistry included the discovery of ferrous ammonium sulphate and of the methods still in use for the analytical separation of iron and manganese and for the decomposition of mineral silicates by fusion with alkaline carbonates."

To this long list of successful labors must be added the memoir on "Air and Fire," which appeared in 1777, and the experimental material for which was partly collected in Malmo and Stockholm before 1770, and partly during Scheele's stay at Upsala, that is, prior to 1776. These dates, Professor Thorpe reminds us, are important in view of Scheele's relations as a discoverer to Priestley and Lavoisier.

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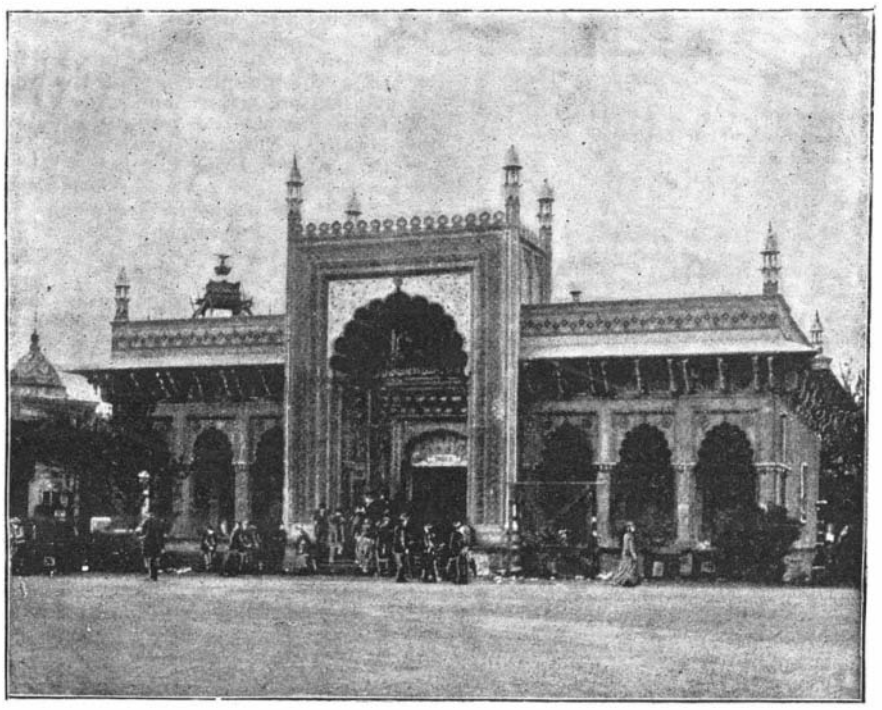
THE COLUMBIAN EXPOSITION—EAST INDIA BUILDING.

The East Indian building was one of the delightful bits of color to which the Exposition proper was almost a stranger. Although the East Indian building was not erected by the government, which decided to make no official exhibit, still the Fair authorities allowed the building, which was built by private enterprise, to be placed in the midst of the buildings erected by various governments. The building measured 80 by 60 feet and was 50 feet high. The material used in its construction was staff, and the splendid polychromatic decoration on the exterior was especially fine. The large room in the interior was reached through a lofty gateway surmounted by small minarets. Goods were sold on the ground floor and in the mezzanine story. In addition to oriental wares, tea was served by red garbed turbaned attendants. The tea was furnished gratuitously to all comers. The building was immensely popular with visitors and was always thronged.



EAST INDIA BUILDING.

Dynamo Telegraphy.

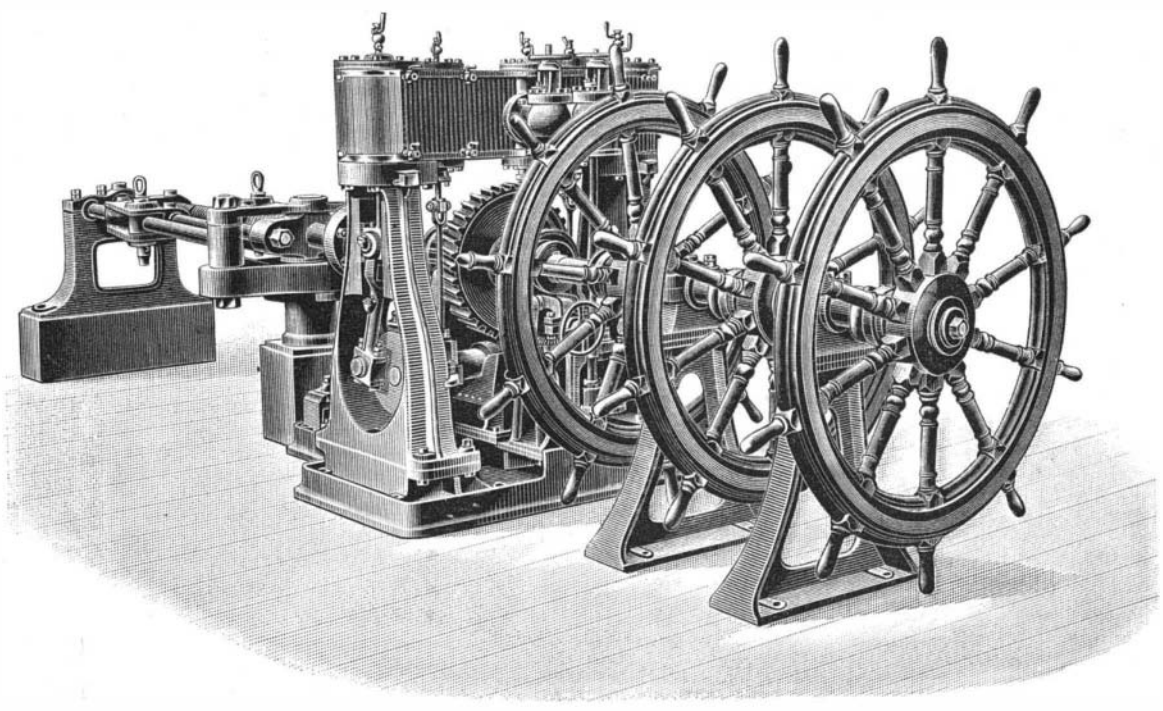
In the Western Union Company's Boston office the current is taken in a commutator on one side of the machine, and sent out from a commutator on the opposite side, the transformation being effected by two different windings on the armature.

The Boston plant has at present nineteen of these transformers in use and will put in addition probably ten more. Of the machines now in use, five are of 3 horse power each, three are 1 horse power, two are ½ horse power, two are ¼ horse power and seven are 1-6 horse power. The potential of these machines varies anywhere from 25 up to 260 volts. The farthest point to which a message has to be sent from Boston is Buffalo, N. Y., and this can be accomplished by throwing one large machine of 260 volts into service or several connected in tandem or in series. The small machines, which are wound for from fifty to seventy volts, are thrown into what is known as the loop from New York to Portland, thus necessitating the sending of but one message.

The use of primary batteries in telegraphing has mostly passed away and the dynamo, with its greater steadiness of current and economy, is now employed.

IMPROVED STEAM STEERING GEAR.

We take from a recent number of *Engineering* the steam steering gear constructed by Messrs. Napier Brothers, Limited, of the Windlass Engine Works, Glasgow, for the new steamers Nile and Danube, of the Royal Mail Steam Packet Company's South American fleet. The gear is arranged to work direct with a double-threaded screw, or, if expediency demands, it may be worked with chain and barrel, operated by quadrant. The change is easily and quickly made, and either of the arrangements can be worked by steam or hand. By a simple arrangement of clutches, the mechanism is shifted from screw to chain barrel gear, or disconnected from steam to work by hand. The cylinders are 10 in. in diameter, and the stroke is 10 in., the steam pressure being 160 lb. to the square inch. On trial on board the Nile, the gear worked from hard over to hard over in 28 seconds. Everything is made to stand heavy strains, all working parts being of steel, the wheels being machine cut. The operating of the valves of the steering engine from the bridge may, of course, be done in many ways; in the Nile and Danube Brown's telemotor system is introduced.



IMPROVED STEAM STEERING GEAR.

Plugs for Spike Holes.

On some of the French railroads the spike holes in ties are filled with plugs of oak or creosoted pine. These plugs used to be manufactured by hand, but were naturally ill-fitting. A simple machine for cutting these plugs has been invented by Albert Collet. It was exhibited first at the Paris Exposition of 1889, and has since been in successful operation. On a single railroad more than a million and a half of the plugs have been used. Their price is $1.80 per 1,000. They are cut in pyramidal shape, with square or octagonal section, out of the best parts of old ties. The use of plugs prolongs the life of ties by several years.

A Great Sunfish.

A fishing party of seven, under the charge of Alex. Mathison, were recently some five miles off the coast of Redondo in the sloop Helen after barracuda. One of their number saw floating in the water what at first was taken for a young whale. On approaching the object it was discovered to be a large sunfish lying on its side, evidently enjoying the sunlight. On the nearer approach of the party the monster dived beneath the boat, coming to the surface a few yards on the other side. The boat was turned and bore down on it once more. In its effort to escape the fish was struck by the bow of the boat and thrown upon its side.

The opportunity was seized to throw a jew-fish hook into its mouth. Gaining its equilibrium, the gigantic fish sped away, the reel humming with the 150 fathoms of line carried with it. Then came a battle royal between the great ocean rover and the fisherman. After long maneuvering, a rope was made fast under its fins and attached to the mast. The boat was nearly dragged beneath the waves by the violent efforts the enormous fish made to escape. Finally, under the pressure of sail and by the exhaustion of its own efforts, it was towed to Redondo and there upon the beach.

The fish is a magnificent specimen of its kind, measuring 11 feet from the dorsal to the anal fin, 8 feet 2 inches in length, and weighed in the neighborhood of 1,800 pounds. When the fact is considered that this is the largest specimen of its species ever captured, it will be of more than passing interest to the general public and of value to the scientific world. The largest heretofore recorded is numbered in the collection of the British Museum, which measures 7 feet 6 inches in length, captured off the coast of Dorsetshire in 1846.—*Los Angeles Herald.*

Explosion of a Compressed Gas Cylinder.

A fatality which occurred recently in the streets of Bradford, England, brings rather prominently under notice an unsuspected source of danger to which the public are exposed from the extended use of compressed oxygen and hydrogen for magic lantern purposes, and to which it appears desirable to direct a little attention. As photographic amateurs will be aware, the gas for operating the oxy-hydrogen light is now supplied in a convenient form in weldless steel cylinders by companies who make a specialty of the manufacture. The gas is compressed in the cylinders to an exceedingly high pressure, 120 atmospheres, or nearly 1,800 lb. per square inch, being about the usual limit. It will be evident that the rupture of a cylinder about 8 inches in diameter and 3 feet or 4 feet in length, under a pressure such as that just named, is not a matter to be trifled with, and that adequate security should, at least, be furnished in the shape of an ample margin of safety. We fear, however, that in this respect many of the cylinders now used are seriously deficient. It is customary, we believe, by those engaged in the trade to test the cylinders up to a pressure of 1½ tons on the inch, and to load them, as we have stated above, to 120 atmospheres, the test pressure being thus rather less than twice the working load, the exact ratio being 1·8. We believe it is not an unusual thing for the cylinders employed to show signs of distress, and be rejected in consequence, even at this low test pressure, while it will probably be a surprise to many to know that a pressure of 2 tons on the inch would cause deformation and bulging in a great many instances. Accepting this as practically the maximum limit of strength, it gives a factor of safety of about 2½. This, we have no hesitation in saying, is insufficient, especially considering the shocks and rough usage to which these vessels are occasionally liable. Their harmless appearance conveys no adequate idea of the enormous store of energy contained within. They are carried about the streets of crowded thoroughfares in charge of boys, who are apt to pitch them from their shoulders, or bring them down on the pavement with a bang, like a log of wood, with possible consequences that are fearful to contemplate. That the danger is not imaginary was fully illustrated by the fatality to which we have alluded at Bradford. A boy, about fourteen years of age, was dispatched by a firm of lantern dealers, with a couple of these cylinders in his charge, to the station. The burden appears to have been somewhat beyond his powers, with the result that he was trailing one of these cylinders after him along the ground, when it suddenly exploded, without a moment's warning, and killed him on the spot, while a man who happened to be behind him was also injured.

We have ourselves frequently seen these charged cylinders handled by porters at railway stations in a way calculated to excite considerable misgiving, and we have wondered whether railway companies were aware of the dangerous character of these harmless-looking vessels, and of the risks which, through acts of carelessness or ignorance on the part of servants, attend their transit. Quite recently we observed them used as log rollers for moving a heavy load in a railway yard.—*Practical Engineer.*

ON one of the transatlantic steamers just about ready to sail from Bremen smoke was seen to issue from a box; upon opening, to see the cause, the material, lupulin, burst into flame. The lupulin had been sent from some part of Bavaria and was to be shipped to this country. The unconsumed portion was found to be thoroughly caked, due to the presence of moisture, and thus furnishes the cause of the ignition: a material, rich in oil; moisture; large quantity and considerable time of storage, by which the heat generated by the slow oxidation of the oil was so much increased that it reached the ignition temperature.—*Sudd. Apotheker Ztg.*

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RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM ACTUATED VALVE. — Henry Breitenstein, Laramie, Wyoming. For direct acting duplex engines this inventor has provided an improvement designed to utilize the steam to the fullest advantage, the construction being simple and durable. The two cylinders are each connected at one end with the opposite end of the other cylinder, the pistons moving in opposite directions in the cylinders, a slide valve controlling the inlet and exhaust ports of the cylinders, while there are puppet valves actuated by the pistons, and differential auxiliary pistons carrying the slide valve and controlled by the puppet valves.

STEAM TRAP.—Henry Creamer, New York City. This is a device of simple and durable construction for automatically conducting water of condensation from engines, steam heating systems, etc., back to the boiler. A receiver for the water of condensation is connected by a port with a fixed neck held on the cylinder and containing an inlet valve adapted to open on the down stroke of the pump piston to admit the water, there being a valve for discharging the water from the piston. The pump is stopped and started according to the quantity of water of condensation received by the receiver, and the pistons of the valve being steam cushioned, their action is comparatively noiseless.

LIQUEFYING GAS.—Francis B. Deane, Lynchburg, Va. To liquefy gas by compression, this inventor has provided a combined hydrostatic press and pump especially adapted to do the work effectively and economically. It comprises twin cylinders in which operate hollow pistons having annular enlarged upper ends and fixed hollow plungers fitting their main bore, the plungers having at their lower end a valved inlet and smaller valved outlet, and being surrounded by annular chambers communicating with the pistons. The gas is first partially compressed, then forced into a much smaller chamber and reduced to liquid form, at the same time that a fresh supply of gas is being drawn in.

VITRIFICATION FURNACE.— Peter K. Sommer, Mannheim, Germany. This furnace comprises a set of gas burners in an inner burning chamber lined with refractory material and surrounded by an outer cylinder for the combustion gases, there being a second outer chamber through which the air passes to the gas burners. The furnace is especially designed for enameling the bottoms of cooking vessels, facilitating the application of heat not only to the bottom but to the sides of the vessel to be enameled.

Railway Appliances.

CAR COUPLING.—Battie K. Richardson, Nashville, Tenn. This is a coupling of the side latching type, of simple and durable construction, and adapted for automatic coupling with a similar coupling on another car, while the uncoupling may be effected from the sides or top of a car. It comprises a chambered drawhead within which are two oppositely pitched inclines, a pivoted latch block riding on the inclines when partially rotated, and sliding by gravity to interlock a notch on its under side with a shoulder on one incline. The device may be conveniently connected with an ordinary car coupling of the link and pin style. Some of these couplings have been tried in actual service, and are said to have proved highly satisfactory.

TRACK SANDING APPARATUS.—Oliver P. Murry and James V. K. Walker, Portsmouth, Va. According to this invention, a valve operating in unison with the engineer's brake valve controls an air blast from the main air reservoir to the sand discharge pipe. When the brake handle is in "full release" or in "running" position the supply of sand to the track is shut off, but when the handle is moved to "lap," before applying the brakes, the sand commences to run, and is forced out when the engineer's valve is moved to put on the brakes, a large quantity of sand being forced upon the rail when the handle is moved to the emergency stop.

CATTLE CAR.—Ferdinand E. Canda, New York City. The protection of the feed and water troughs of a cattle car against injury when the car is loaded with general freight is the design of this improvement. Ordinarily the posts of the car are made wide, to allow the troughs to be folded up between them, and thus protect the troughs from injury, but according to this invention the troughs are pivoted between the posts and are flanked by protecting blocks, brackets and a guard rail, allowing the width of the posts to be greatly reduced, and at the same time effectively protecting the troughs from injury by freight.

TRAIN ORDER AND SIGNALING DEVICE.—Leonard T. Crabtree, New London, Wis. This is an improvement upon formerly patented inventions of the same inventor in devices for railroads using the block signal, and embracing mechanism for the control of moving trains, embodying also a train signaling device and a co-operating train order annunciator. Combined with a rotatable pendently supported signal blade, a top-heavy gravity block pivotally supported near its lower end, and a device connecting the block with the blade, is an electrical device which when active holds the block nearly upright, and releases the block to allow it to rock when the electrical device is dormant. The invention also embraces various other novel features designed to simplify the construction and insure certainty of action.

Mechanical.

CARPENTER'S AND JOINER'S SQUARE.—Solomon H. Bretz, Battle Creek, Mich. This is a composite tool in which the limbs are jointed together and graduated on arcs of circles defined by two undercut opposite shoulders on one limb, and bevel edged and mating curved flanges on the other limb, the flanges having a sliding contact with the shoulders and being radially coincident. The implement has also a plumb and level attachment, and rafter and brace tables to indicate lengths for such parts of a building, the tables being impressed upon a sunken portion of each limb, and thereby protected from obliteration by wear.

WIRE SWAGING MACHINE. — Albert De M. Ramacciotti, New York City (executor of Francis Ramacciotti, deceased). This is a machine especially adapted for swaging wire strings for musical instruments, the machine being adjustable to operate upon strings of various lengths and of high temper, leaving the strings at their flattened surfaces smooth and flawless. The improvement comprises a sliding carrier provided with a swaging block, a second carrier bemg an adjustable wedge section at a right angle, while a block section may be adjusted by the wedge section in direction of or away from the sliding carrier, the block having a swaging jaw adapted to face that of the sliding carrier.

MILLSTONE DRESS.—Joseph H. Brown, Madison, Ga. According to this improvement the millstone has main furrows and auxiliary furrows extending to the skirt of the stone, and at the center the face is sloped slightly toward the eye or draft circle. Across the main and auxiliary furrows are shoulders facing inwardly, the dressing being of a novel character to partially overcome centrifugal force on the coarse particles, while preventing regrinding of fine particles to cause heating and undue wear of the stone. Stones with this dress can be run farther apart, and with less friction and cooler, than has been usual heretofore.

Miscellaneous.

WHEELED SCRAPER.—William Ackerman and Albert A. Hasselquist, box No. 532, Elgin, Ill. This is a machine carrying a scoop, and adapted for scraping roads or similar work, the scoop being entirely under the control of one man, who may also drive the team by which the machine is drawn along. The construction is simple and the scoop may be held positively in the position desired according as the ground is to be scraped, or it may be raised to a carrying position above the ground, being raised or lowered at the will of the operator, and dumped by the action of the team.

WAGON DUMPING DEVICE.— Charles H. Peardon, Smithshire, Ill. This inventor has provided improved means for elevating a loaded wagon and the subsequent dumping discharge of the load automatically. A framed structure is erected to afford an inclined way to the point where the dumping is to be effected, and at such place a platform is supported by a transverse shaft, whereby the platform may be rocked to tip the wagon body, there being connected with the structure a draft cable for attachment to a wagon, whereby the latter may be drawn up, on the application of power from a suitable source, and its load dumped when the platform is tripped.

PROPELLER. — Martin Davies, Jersey City, N. J. This inventor has provided an improved means of securing propeller blades to the hub or end of the screw shaft. The hub has radial bores, countersunk on the inner side, and the propeller blades have a perforated base, and screw bolts have their heads fitted in their countersinks and their shanks projected outward through the hub and bases of the blades. The heads of the bolts are preferably arranged to form part of the smooth hub bearing for the propeller shaft. This invention has been practically tested in a working propeller, and has been demonstrated to possess decided advantages.

PNEUMATIC VALVE.—Fredrick Fichter, Rockaway, N. J. This is an improvement especially adapted for use in connection with inflated cushions, pneumatic tires, etc. The valve is provided with double cushions, and within one casing two valves are made to act in conjunction, both valves to be employed when the inflation is to be effected, after which one is to be removed. The valve is of simple and durable construction and ready application, and, when closed, the escape of air through it is impossible.

DRUGGIST'S STILL.—Charl s R. R. Beck, Baltimore, Md. The conical condensing hood of this apparatus has at its apex a filling opening, and from base to top is surrounded by a water jacket, with inlet and outlet openings near the top and bottom to permit water circulation, while there is a base trough and a supplemental trough above it within the hood, the latter provided with a discharge pipe. The improvement affords improved means for distilling various extracts and waters, collecting all the condensations and conducting them out of the still, instead of permitting some of them to fall back into the heating vessel.

ENVELOPE OR STAMP MOISTENER.—Henry A. Fry, Chicago, Ill. This is a simple device to be conveniently worn on the thumb, to facilitate the rapid and efficient moistening of stamps and envelopes. It comprises a reservoir and keeper for attaching the reservoir to the hand, in connection with a moistening pad arranged beneath, and a valve-controlled connection between the reservoir and pad. The device may be very quickly operated, the shape of the pad enabling the moisture to be evenly applied.

CLAMP JOINT. — Frances Higbie, Brooklyn, N. Y. This is an extremely simple device, comprising a vertical standard or support, in the form of a rod, on which a bracket is conveniently adjustable up or down, while a base piece in horse-shoe pattern has at one edge a neck with an opening adapted to receive the lower end of the vertical standard, with which it is engaged by a clamping arm. The device affords a convenient means of supporting a cooking vessel at such height as desired above a lamp, the vessel being placed on the bracket, of a construction adapted for the purpose, and the lamp base being encircled by the base piece.

FAN.—Edward Ross, Brooklyn, N. Y. This is an improvement in fans having a folding web adapted to open in circular form, and the invention describes a simple and durable fan, which can be readily opened and closed and locked in either position. The handle is made solid, and not in two parts, as usual, giving the fan a neater appearance, and its web can be easier opened or closed without changing the grip on the handle.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE LATIN LETTER OF COLUMBUS. Printed in 1493, and announcing the discovery of America, reproduced in facsimile, with a preface. London: Bernard Quaritch. 1893. Pp. vi, 8. Price 30 cents.

HARIOT'S NARRATIVE OF THE FIRST PLANTATION OF VIRGINIA IN 1585. Printed in 1588 and 1590, reprinted from the edition of 1590 with De Bry's engravings. London: Bernard Quaritch. 1893. Pp. vi, 46, 25 plates. Price 60 cents.

THE SPANISH LETTER OF COLUMBUS WRITTEN BY HIM ON FEBRUARY 15, 1493. To announce the discovery of America. Reproduced in facsimile from the unique copy of the original edition. (Barcelona, April, 1493.) With a translation and introduction. London: Bernard Quaritch. 1893. Pp. xiv, 18. Price 40 cents.

These three very elegant publications are explained by their titles. They are of wide interest among those who occupy themselves with the early history of the continent. The illustrations in some cases are exceedingly interesting.

EXPERIMENTS ON AIR. PAPERS PUBLISHED IN THE PHILOSOPHICAL TRANSACTIONS. By the Hon. Henry Cavendish. Edinburgh: William F. Clay. London: Simpkin, Marshall, Hamilton, Kent & Co., Limited. 1893. Pp. 52. No contents, no index.

Cavendish's famous work referring to the period of 1784–1785 figures as the third of the Alembic Club reprints, and certainly cannot be considered the least valuable or interesting of them. This work will certainly find its way to all chemical libraries. The absence of a contents and index we feel, however, cannot but be regretted.

LES MERVEILLES DE L'EXPOSITION DE CHICAGO. By N. Melnikoff. Odessa, Russia: 32 Rue Catherine. 8vo. Pp. 96, illustrated.

This work, which is in Russian, describes the principal exhibits. It is curious to note that M. Melnikoff is greatly in favor of introducing two articles into Russia which have generally been regarded as strictly American—peanuts and popcorn.

SCIENTIFIC AMERICAN BUILDING EDITION.

DECEMBER, 1893.—(No. 98.)

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2. Plate in colors showing the residence of Thomas C. Wordin, Esq., at Bridgeport, Conn. Two perspective views and floor plans. Cost $5,000 complete. A very attractive Queen Anne design. Mr. Henry A. Lambert, architect, Bridgeport, Conn.
3. A dwelling erected for Edward W. Alling, Esq., at New Haven, Conn. Perspective and interior view and floor plans. An excellent design. Cost $4,500 complete. Messrs. Stilson & Brown, architects, New Haven, Conn.
4. A very attractive residence recently erected for R. Burton, Esq., at Hartford, Conn., at a cost of $7,800 complete. Floor plans, perspective view, etc. Mr. Henry D. Hooker, architect, New York. An excellent design.
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6. A dwelling recently erected for P. H. Lucas, Esq., at Chester Hill, Mt. Vernon, N. Y., at a cost of $7,000. Floor plans and perspective elevation, also an interior view. Mr. Louis H. Lucas, architect, Mt. Vernon, N. Y.
7. A cottage at Mystic, Conn., erected at a cost of $3,000 complete. Elevation and floor plans and an interior view. Mr. John S. Rathbone, architect, New London, Conn.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(5543) F. G. H. asks: 1. Are No. 18 and No. 25 good sizes of wire to use on a medical coil? A. No. 25 wire is too thick. Use No. 30 or finer. 2. Which magnet will give the strongest current, one 4 inches long, wound with 1 ounce No. 18 and 3 ounces No. 24, or one 2 inches long wound with 1 ounce No. 18 and 3 ounces 24? A. If you refer to horse shoe magnets, the shorter one, if of same diameter of core, should give the best effects.

(5544) J. O. J. asks: 1. Is tungsten steel the same as Mushet steel, and what tempering it requires to make permanent magnets (suitable for voltmeter, etc.)? A. Mushet steel and tungsten steel are much alike in their quality of soft tempering, but may not be of the component alloys. They must not be dipped in water for tempering, simply cool in the air. 2. I have in mind a silvered glass reflecting telescope. Mirror 4½ to 5 inches diameter and 3 feet focal length. Are the measures well proportioned? A. A good proportion for a reflecting telescope is 12 times the diameter of the mirror for the focal length. 3. Is it necessary to grind the mirror to the meniscus form, or will a plano-convex do? Will the silvering process described in last week's SCIENTIFIC AMERICAN be applicable to silvering it? Where can I get considerable general information regarding reflecting telescopes? A. The silvering should be on the front surface, which should be perfectly polished to the proper curve. For the silvering process and description of requirement for grinding and polishing for astronomical telescopes, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 581, 582, 583, 10 cents each mailed.

(5545) J. F. H. says: Will you kindly explain through the SCIENTIFIC AMERICAN what is the difference between a mechanic and a machinist? A. A machinist is a mechanic, but all mechanics are not strictly machinists. Carpenters, wagon makers, millwrights, cabinet makers, and every one skilled in the practice of the mechanic arts are properly mechanics. Machinists are more properly constructors of machines and engines, and versed in the principles of construction of machinery.

(5546) M. P. H. asks: What progress, if any, has been made in hardening copper? Has any one since prehistoric times been able to get it so it would take a razor edge and hold it? If not, what would you think of a process that could harden an alloy of 85 per cent copper and 15 per cent tin to that degree that it would take and hold an edge sufficient for all wood-working tools? If this result has not been attained by any one else, I will send a specimen of what we have. A.

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Very little progress has been made in tempering copper equal to the asserted claims referred to the prehistoric Egyptians. Although parties in the United States claim to have hardening processes for copper, there appear to be no claims for making copper edge tools that will compare with steel. We have made bronze compositions of pure copper and tin that made fair cutting tools, such as knives and cold chisels, that would cut wood, marble, and the softer metals, but when you come to strike into a granite or syenite block, the chisel is not there. We shall be pleased to have a specimen of your hard bronze that is a cutting tool.

(5547) T. T. H. says: Will you please let me know what horse power I can get 80 feet from the boiler through a 1¼ inch pipe with 5 ells on in the length with 60 pounds pressure at the boiler? A. You should be able to obtain from 8 to 10 indicated horse power with the pipe as stated, if well felted.

(5548) A. G.—Compressed air jets have been proposed for propelling boats.

(5549) T. H. M., Jr., says: 1. I want to know if one force pump will pump water out of three wells. The water is supposed to be 10 feet from the surface, also 10 feet from the pump cylinder. The above pump is only to have one standard and one cylinder. Will the above pump draw water out of all the wells? A. The pump will draw from the three wells if the water stands at the same height in all of them. A dozen drive wells are sometimes connected to one pump. 2. What causes natural gas? A. Natural gas is supposed to be the product of the decomposition of petroleum.

(5550) J. L. asks: 1. Would gas-house tar, applied warm with a brush, have a greater tendency to clog the latter when it cools than when used cold? A. The hot tar dries quicker than cold tar and would be more apt to clog the brush. 2. Would it be practicable to pass the tar through a coil pipe, contained in a cylinder and heated by steam, and is there any danger of the tar choking the coil when it cools? A. If the tar is fluid when cold, it would not choke the coil. Passing through a coil heated by steam would not change its drying quality and it would still be fluid after passage. 3. Will tar dry quicker, applied hot to a cold surface or applied cold to a hot surface? A. Tar dries quickest applied to a hot surface.

(5551) C.—The loss of power in steam engines from back pressure in the exhaust is very trifling. No engine, if properly piped, should have more than one-quarter pound back pressure per square inch, which would be but one-half per cent at 50 pounds mean pressure.

(5552) J. A. W. says: A river 14 feet deep flows past our dock with a velocity of 3 miles an hour. What horse power can I derive from the river with a paddle wheel 6 feet broad and 34 feet in diameter, extending 12 feet down into the water, the shaft of which would therefore be 5 feet above the water, and therefore above the level of the dock? If the paddle wheel is not the best device for utilizing the force of the current, what other device is? A. You may obtain about 8 horse power from the paddle wheel, which is probably the best for the purpose.

(5553) J. McB. asks how to purify sperm oil for lubricating. I have a quantity which has become gummy. How can I treat it to remove gum? A. Add to each gallon of gummy oil, 1 ounce, each of chalk and slaked lime and ¾ of a pint of water; stir the mixture thoroughly, let it stand for a few days, and then add ¾ of a pint of water and 3 ounces potash; stir and heat to nearly the boiling point. Then add a solution of 1 ounce salt to ¾ pint of water, and slowly boil the mass for a half hour and pour into a vessel to settle, when the clear oil may be decanted, or you may simply expose to the sun for a few days, putting the oil in a lead tray.

(5554) L. A. H. says: 1. Will you kindly tell me how copper oxide is made? A. Copper monoxide (cupric oxide) is made by calcining metallic copper at a red heat with full exposure to the air. Red oxide of copper or cuprous oxide is made by heating in a covered crucible a mixture of 5 parts black oxide of copper and 4 parts of fine copper filings. 2. Also of some solution which is rubbed on copper which causes the same to turn a beautiful highly colored polished red. A. The red copper surface is made by dipping the articles in a solution of 2 drachms sulphate of antimony and 1 ounce pearlash, dissolved in 1 pint of water. 3. Tell me how iron scroll work is made a dead black? A. For a black polish on iron boil together oil of turpentine 15 parts and sulphur 1½ parts. Put a thin coat on the iron and burn off with an alcohol lamp. 4. Also can silver nitrate be changed into chloride of silver, or can it be changed so that it can be used in an electroplating solution where chloride of silver is used? A. For the silver bath use 5¼ ounces nitrate of silver to 1 gallon soft water. Then add 8 ounces cyanide of potassium. You can precipitate silver chloride from a solution of the nitrate by adding hydrochloric acid. Then filter and wash and you have silver chloride ready for use in any formula calling for it. Do the work by gas light or in a dark room.

(5555) M. H. S.—The Campania, like all the great ocean steamers, is flat on the bottom through the midship section.

(5556) A. G. G. asks: 1. On a clock circuit is a relay of 20 ohms resistance; this relay has under it a resistance coil of German silver wire connected on shunt. What is the resistance coil on there for? A. The resistance coil is designed to prevent sparking at the relay; it provides a path for the extra current. 2. I have a 20 ohms relay. If I add a resistance of 130 ohms on shunt, will this bring relay to 150 ohms, so it will work on main line where 150 ohms relays are used? A. This depends upon the connections. We presume that the resistance should be comprised in the coils of the magnet, yet it is not at all certain that this is necessary in your case. Fuller details must be given to obtain a definite solution. 3. How is ferric ammonium citrate prepared? A. Dissolve 29 parts iron tersulphate in water, precipitate with excess of ammonia, filter, wash, and dissolve the filtrate with 30 parts citric acid, evaporate to 100 parts. To above add 33⅓ parts solution of ammonia (10 per cent or sp. gr. 0·959 at 59° Fah.), mix, and evaporate to a sirup, pour on glass and allow to solidify. Use no heat exceeding 140° Fah. in any part of the process.

(5557) H. B. writes: I have a lot of scrap rubber; can I use that for making hard rubber for electric purposes? Or can you give me a good receipt for a substitute? A. There is no good substitute for hard rubber. Fiber is sometimes used. On an emergency use pasteboard soaked in hot paraffine. You can do nothing with the old scrap. 2. What size wire should I use on a telephone line ½ mile long? A. Use copper No. 18 or iron wire No. 12.

(5558) J. R. D. writes: How can I best magnetize a circular disk of iron or steel? I have tried numerous devices, but have been unsuccessful. A. It depends on how you want the magnetism distributed. By placing it within a coil and passing a strong current through the coil it will become magnetized in a general sense diametrically. By rotating it over the poles of a horseshoe magnet, keeping its center over one pole and its periphery moving over the other, it may be magnetized radially. By spinning it horizontally in front of a strong pole, circular polarization may be produced. Any method may give only partial success, as consequent poles will probably be produced.

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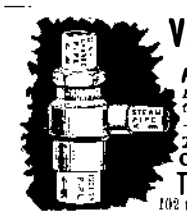

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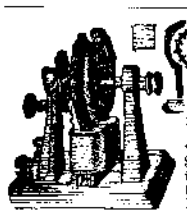

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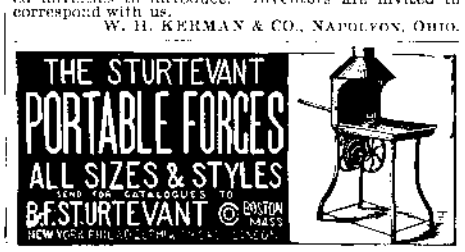

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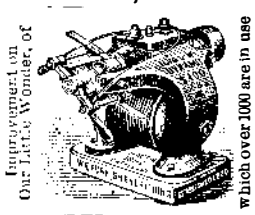

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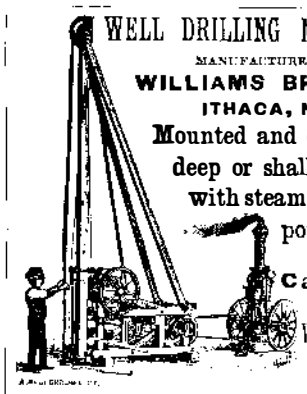

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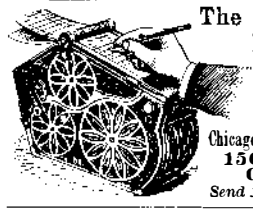

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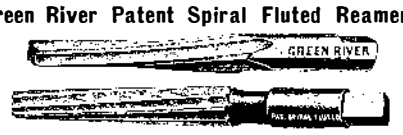

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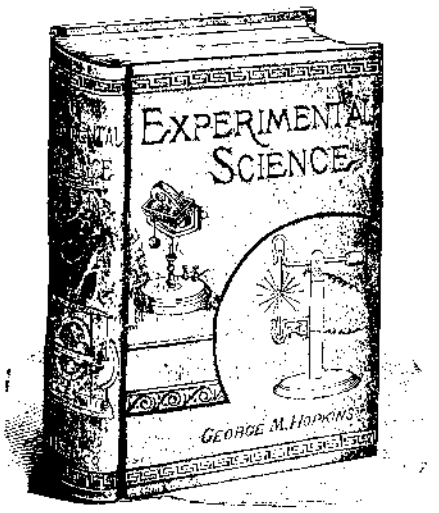

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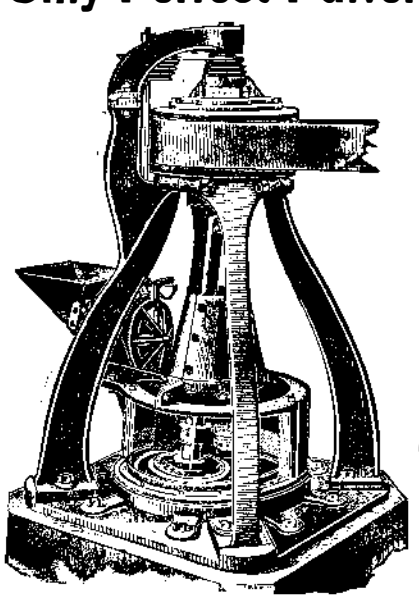

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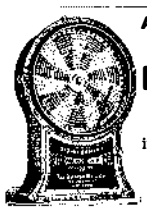

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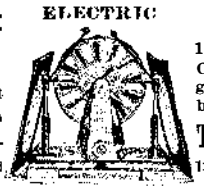

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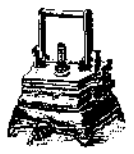

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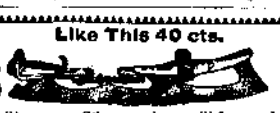

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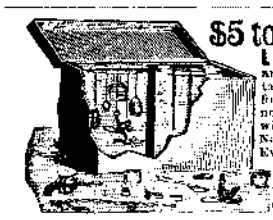

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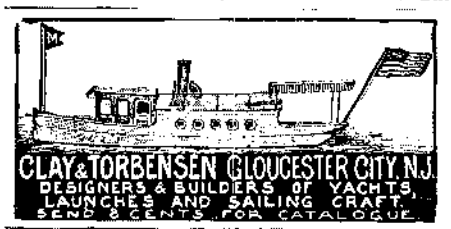

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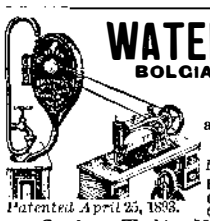

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This Company also owns Letters Patent No. 463,569, granted to Emile Berliner, November 17, 1891, for a Combined Telegraph and Telephone; and controls Letters Patent No. 474,231, granted to Thomas A. Edison, May 3, 1892, for a Speaking Telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.

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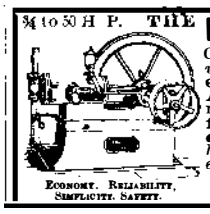

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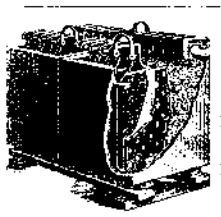

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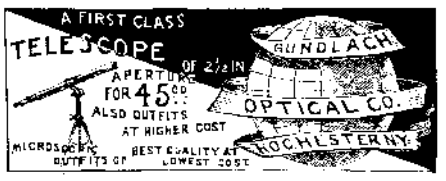

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